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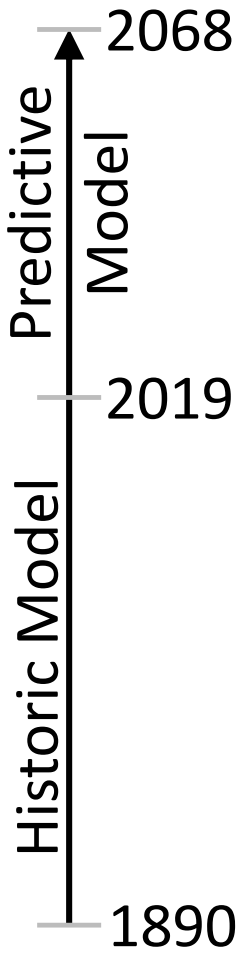
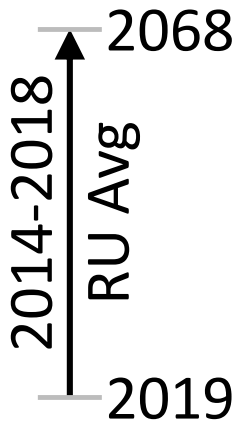
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

VAHYDROGW-VCPM: 2018-2019 ANNUAL SIMULATION OF REPORTED AND TOTAL PERMITTED USE

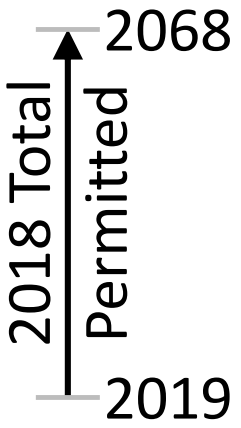
VCPM Groundwater Simulations

- VCPM Adaptation
  - 2013 Updated and adapted for DEQ use
    - 2003 -2012 data
    - RU and TP created
  - 2015-16 RU and TP updated
  - 2016 Addition of subsidence package
  - 2016-17 RU and TP updated
  - 2017-18 RU and TP updated
  - 2018 – Framework updated
  - 2019 – Recalibration
  - 2018-19 RU and TP updated





2018 Reported Use Simulation



2019 Total Permitted Simulation

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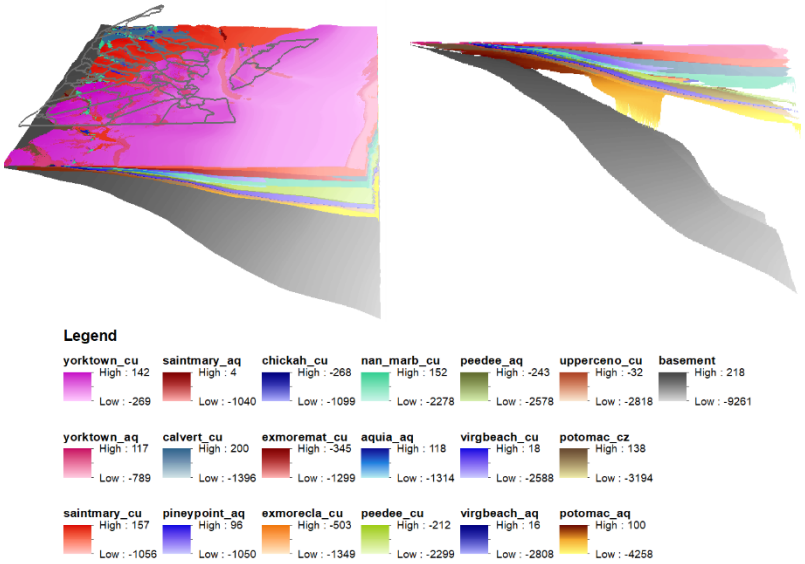
VCPM - Hydrogeologic Framework Update

	Hydrogeologic Unit Name	Raster Name	HUF Unit	HUF Array
1	Surficial Aquifer	m01_surf	Columbia_a	SURF
2	Yorktown-Eastover Confining Unit	yorktown_cu	Yorktown_c	YTCZ
3	Yorktown-Eastover Aquifer	yorktown_aq	YorkEast_a	YEAQ
4	Saint Marys Confining Unit	saintmary_cu	St_Marys_c	SMCU
5	Saint Marys Aquifer	saintmary_aq	St_Marys_a	SMAQ
6	Calvert Confining Unit	calvert_cu	Calvert_c	CACU
7	Piney Point Aquifer	pineypoint_aq	Piney_Pt_a	PPAQ
8	Chickahominy Confining Unit	chickah_cu	Chickaho_c	CHCU
9	Exmore Matrix Confining Unit	exmoremat_cu	Exmore_m_c	XMCU
10	Exmore Clast Confining Unit	exmorecla_cu	Exmore_c_a	XCAQ
11	Nanjemoy-Marlboro Confining Unit	nan_marb_cu	Nan_Marl_c	NMCU
12	Aquia Aquifer	aquia_aq	Aquia_a	AQAQ
13	Peedee Confining Unit	peedee_cu	Peedee_c	PDCU
14	Peedee Aquifer	peedee_aq	Peedee_a	PDAQ
15	Virginia Beach Confining Zone	virgbeach_cu	Virginia_c	VBCU
16	Virginia Beach Aquifer	virgbeach_aq	Virginia_a	VBAQ
17	Upper Cenomanian Confining Unit	upperceno_cu	Upper_Ce_c	UCCU
18	Potomac Confining Zone	potomac_cz	Potomac_c	POCZ
19	Potomac Aquifer	potomac_aq	Potomac_a	POAQ
20	Basement Bedrock	basement	-	-



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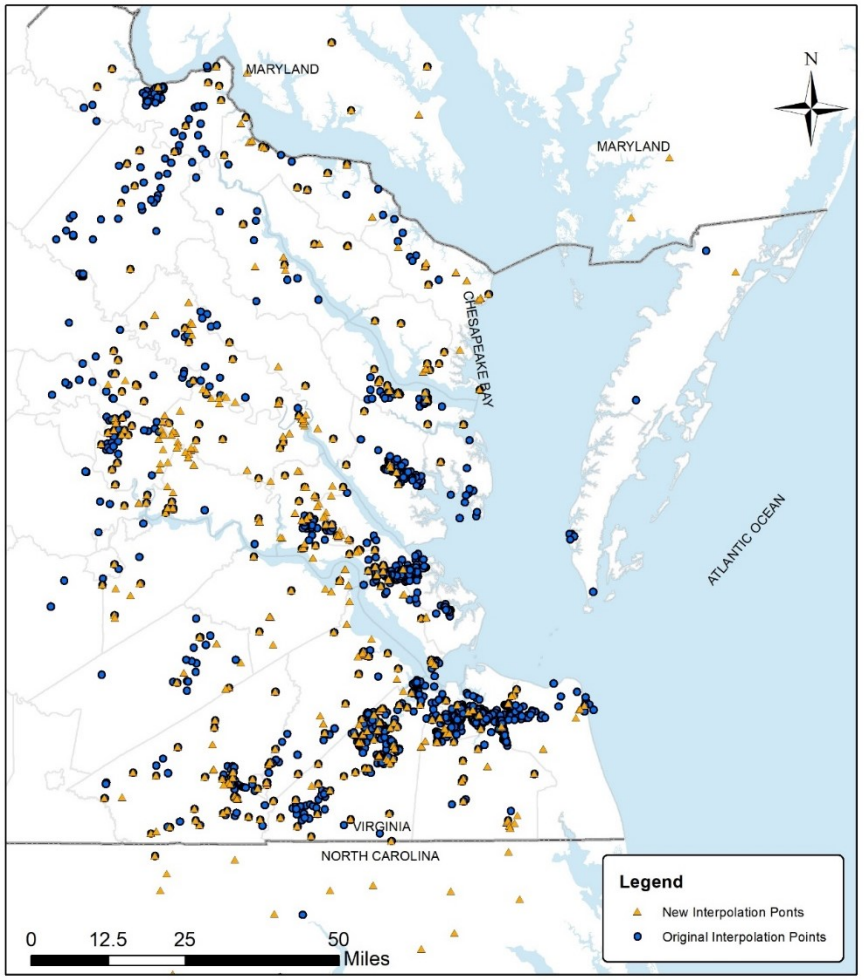
VCPM - Hydrogeologic Framework Update

Hydrogeologic Unit Name	2006 HFR Interpolation	DEQ Evaluation Template	Potomac/ Piney Point Reports	Total Interpolation Points
Yorktown-Eastover Confining Unit	125	5		130
Yorktown-Eastover Aquifer	180	5		185
Saint Marys Confining Unit	283	18		301
Saint Marys Aquifer	39	2		41
Calvert Confining Unit	259			259
Piney Point Aquifer	251	26	66	343
Chickahominy Confining Unit	44			44
Exmore Matrix Confining Unit	30			30
Exmore Clast Confining Unit	18			18
Nanjemoy-Marlboro Confining Unit	269	16		285
Aquia Aquifer	261	12		273
Peedee Confining Unit	4			4
Peedee Aquifer	4			4
Virginia Beach Confining Zone	33			33
Virginia Beach Aquifer	33			33
Upper Cenomanian Confining Unit	97	1		98
Potomac Confining Zone	307	7		314
Potomac Aquifer	308	41	35	384
Basement Bedrock	65	7	378	450
TOTAL:	**2610**	**140**	**479**	**3229**



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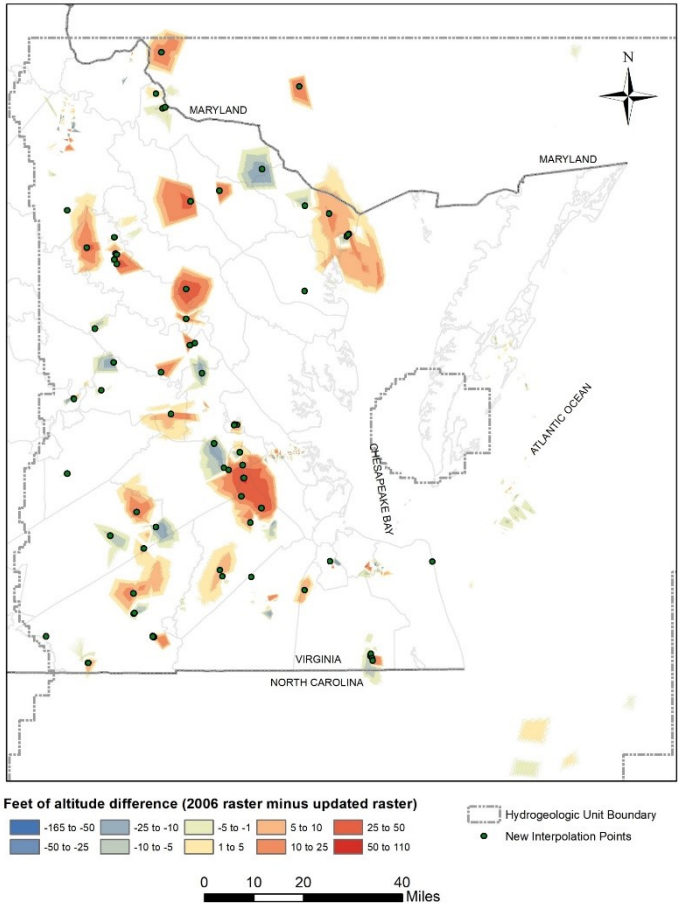
VCPM - Hydrogeologic Framework Update

Hydrogeologic Unit Name	New Interpolation Points	Max Distance Above Original HFR (ft)	Max Distance Below Original HFR (ft)	Percentage of Unit with More than One Foot of Change
Yorktown-Eastover Confining Unit	5	25	23	0.30%
Yorktown-Eastover Aquifer	5	100	17	0.30%
Saint Marys Confining Unit	18	25	27	1.20%
Saint Marys Aquifer	2	25	7	0.10%
Piney Point Aquifer	92	24	20	5.60%
Nanjemoy-Marlboro Confining Unit	16	25	19	2.40%
Aquia Aquifer	12	25	15	3.30%
Upper Cenomanian Confining Unit	1	32	9	0.30%
Potomac Confining Zone	7	33	36	1.50%
Potomac Aquifer	76	41	60	6.60%
Basement Bedrock	385	164	109	9.60%

Potomac Aquifer
2006 HFR Minus Updated HFR



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VCPM – Hydraulic Properties Recalibration

Unit	Hydrogeologic Unit Name	Original Observation Wells	Original Observations		New Observation Wells	New Observations
1	Surficial aquifer	16	207		9	36
2	Yorktown confining zone	6	54		-	-
3	Yorktown-Eastover aquifer	19	239		12	87
4	St. Marys confining unit	2	26		-	-
5	St. Marys aquifer	1	13		-	-
6	Calvert confining unit	-	-		1	5
7	Piney Point aquifer	7	79		9	46
8	Chickahominy confining unit	1	13		-	-
9	Exmore Matrix confining unit	1	13		-	-
10	Exmore Clast confining unit	1	13		-	-
11	Nanjemoy-Marlboro confining unit	2	24		2	2
12	Aquia aquifer	5	65		2	10
13	Peedee confining unit	1	13		-	-
14	Peedee aquifer	1	13		-	-
15	Virginia Beach confining unit	-	-		-	-
16	Virginia Beach aquifer	-	-		1	2
17	Upper Cenomanian confining unit	2	26		-	-
18	Potomac confining zone	3	39		-	-
19	Potomac aquifer	76	934		35	165
		144	**1771**		**71**	**353**

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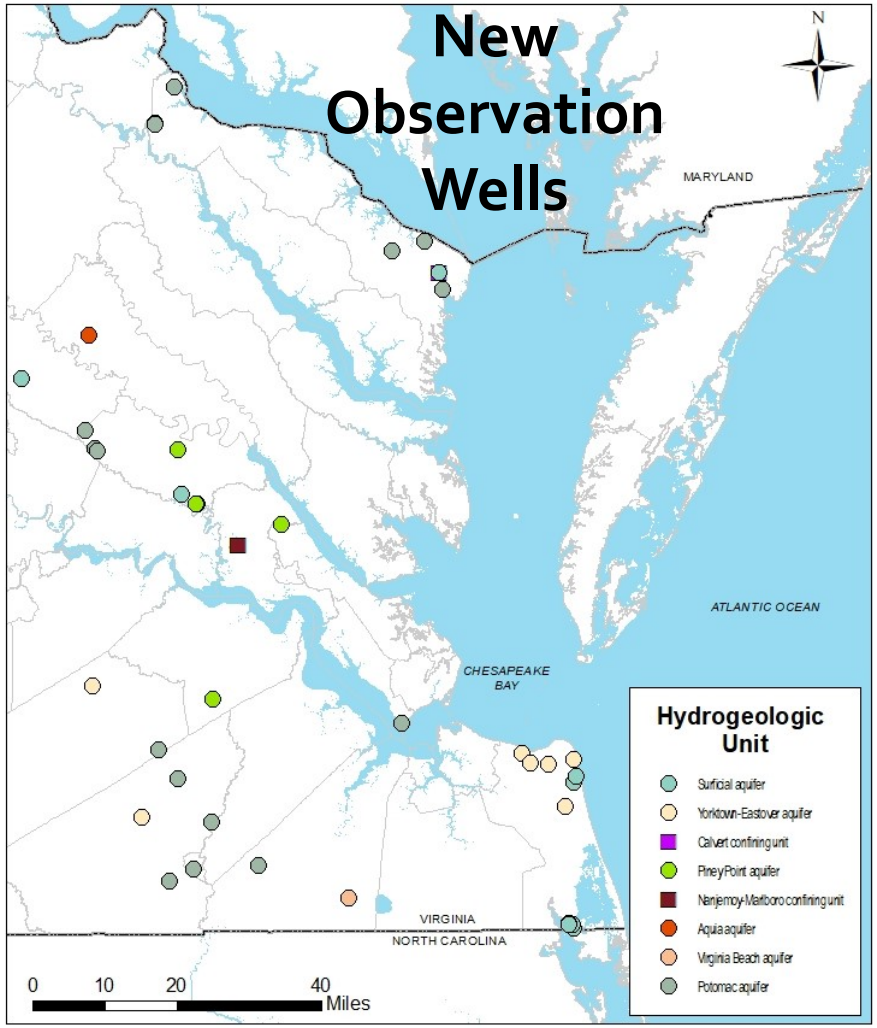
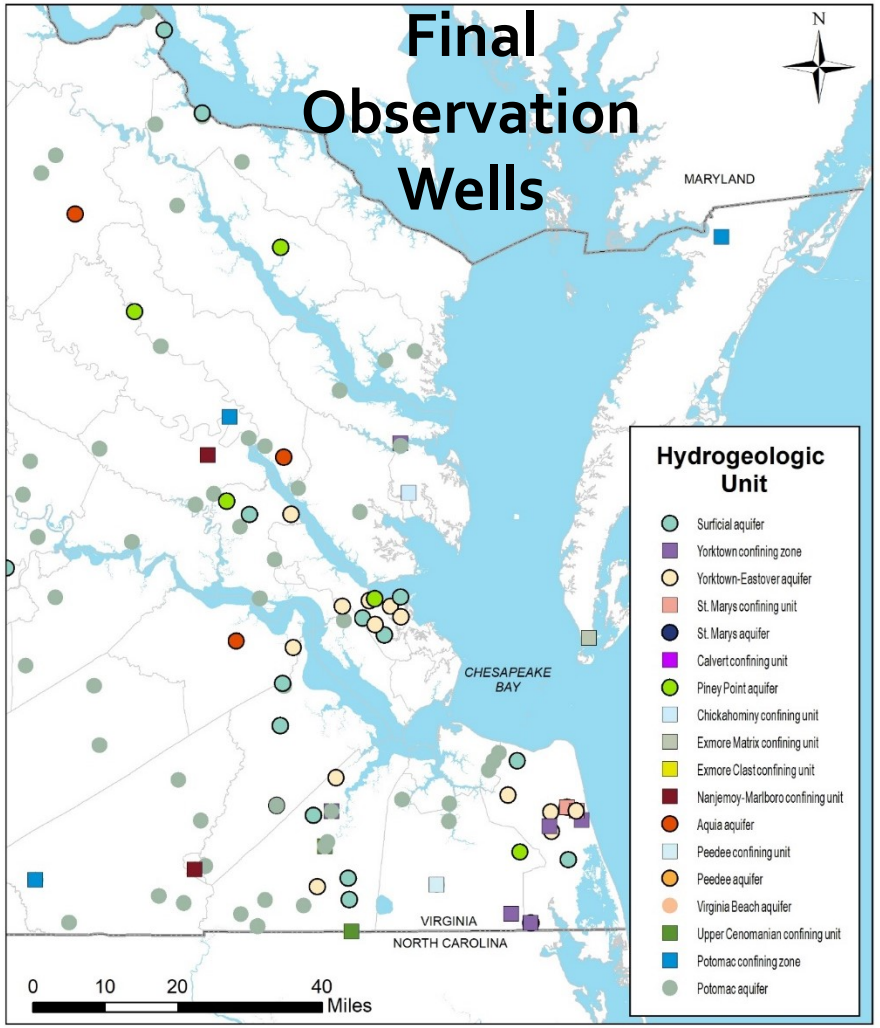
VCPM – Hydraulic Properties Recalibration





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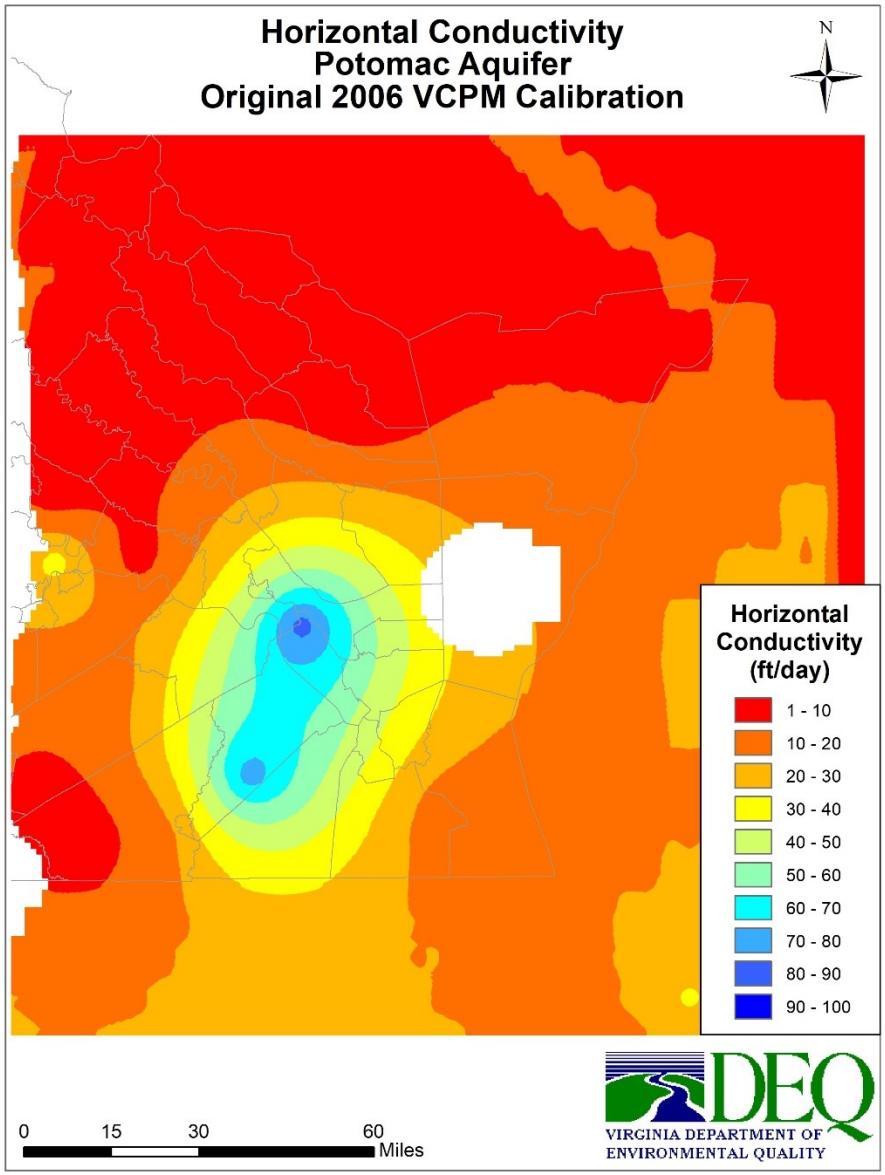

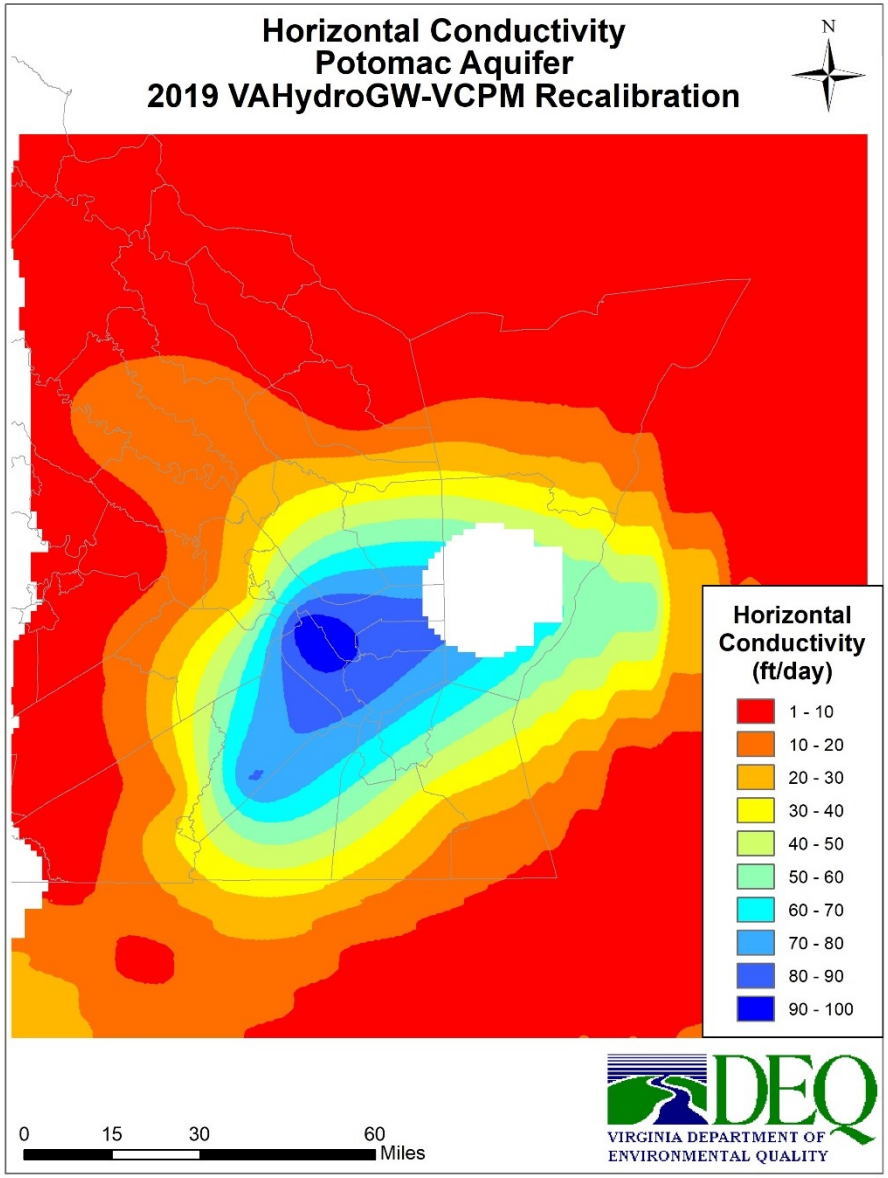

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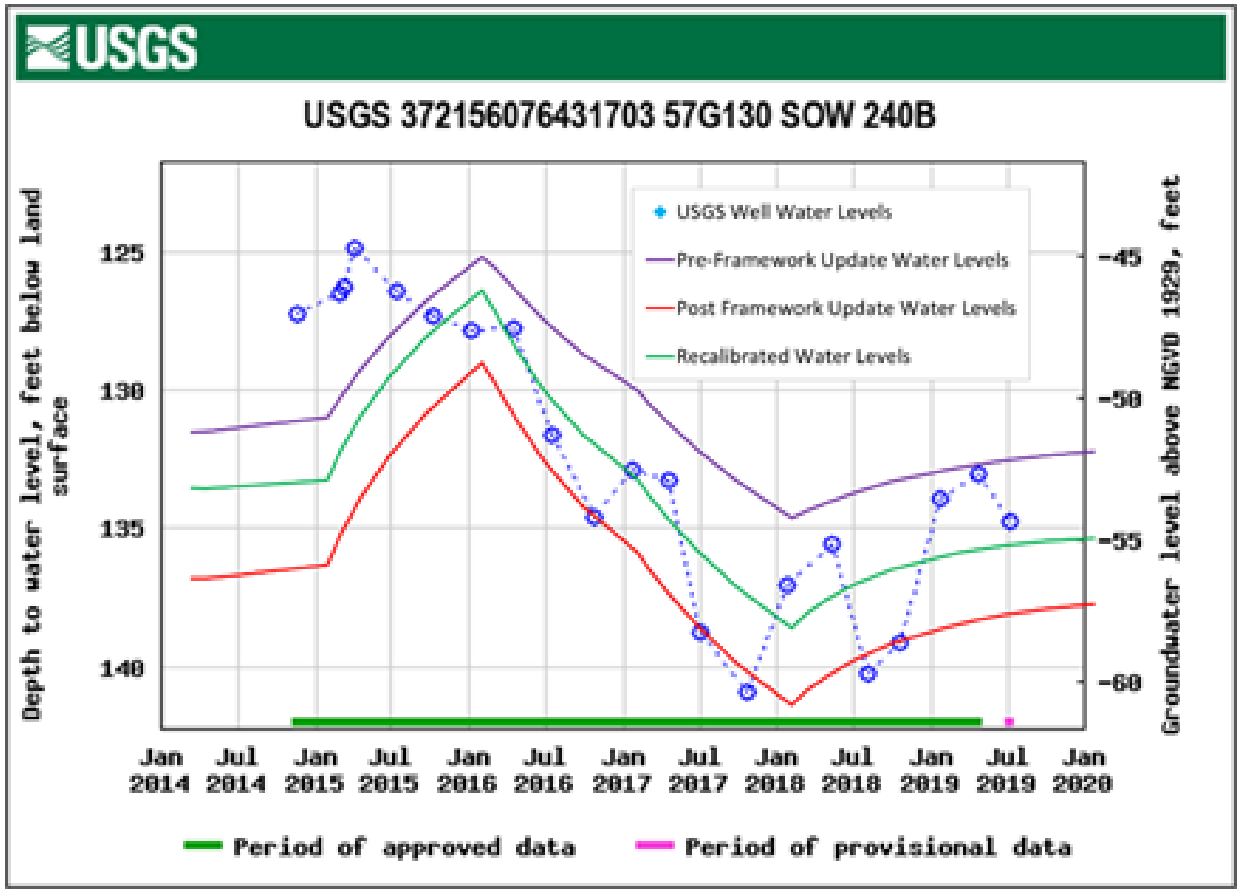

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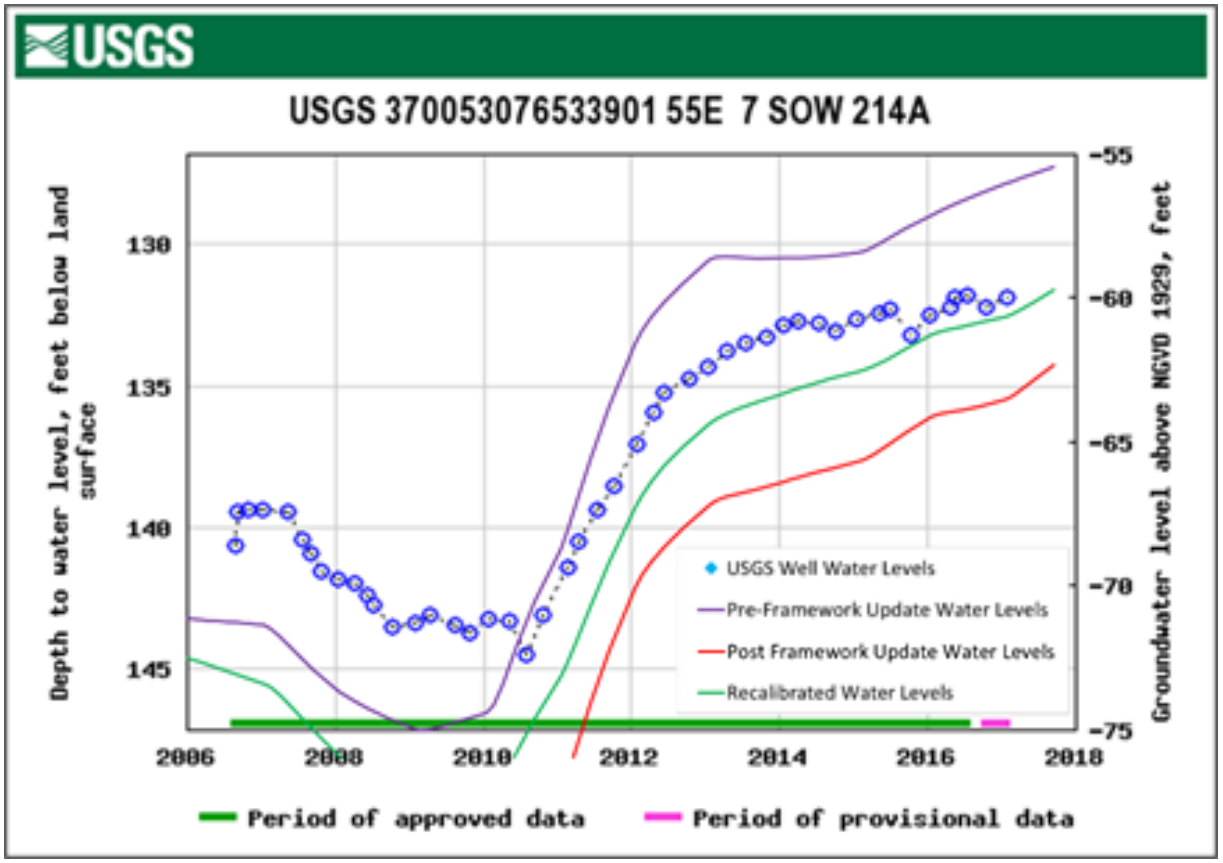

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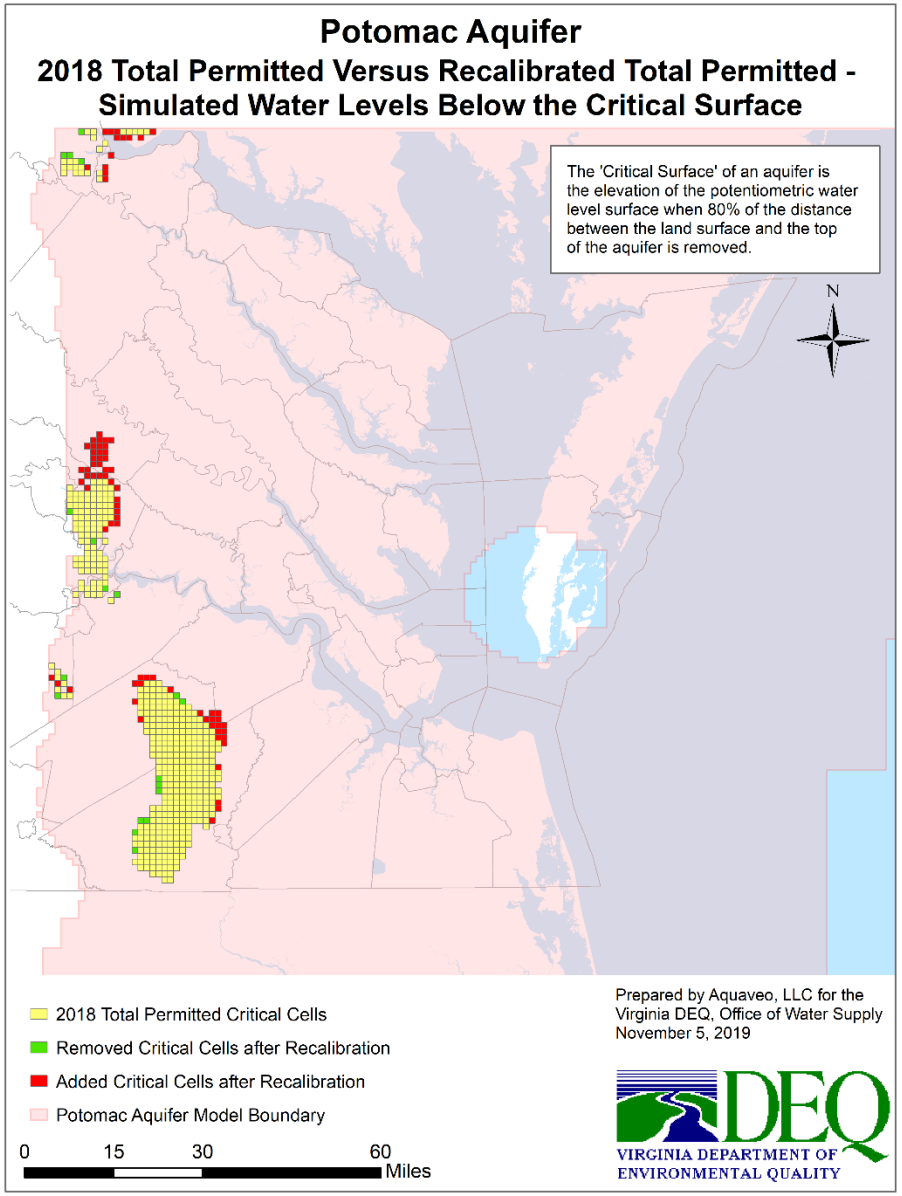

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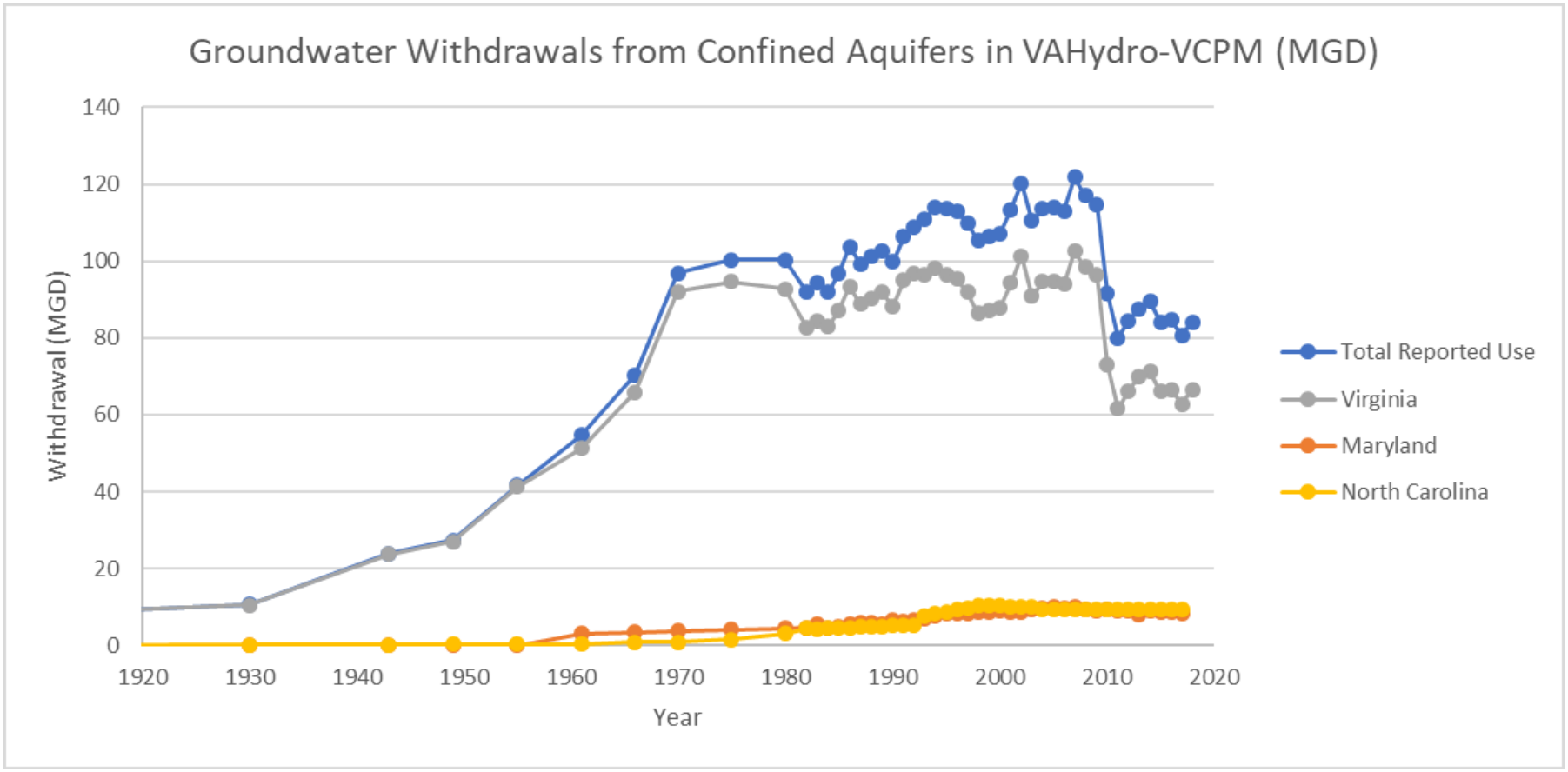
VCPM – Reported Use



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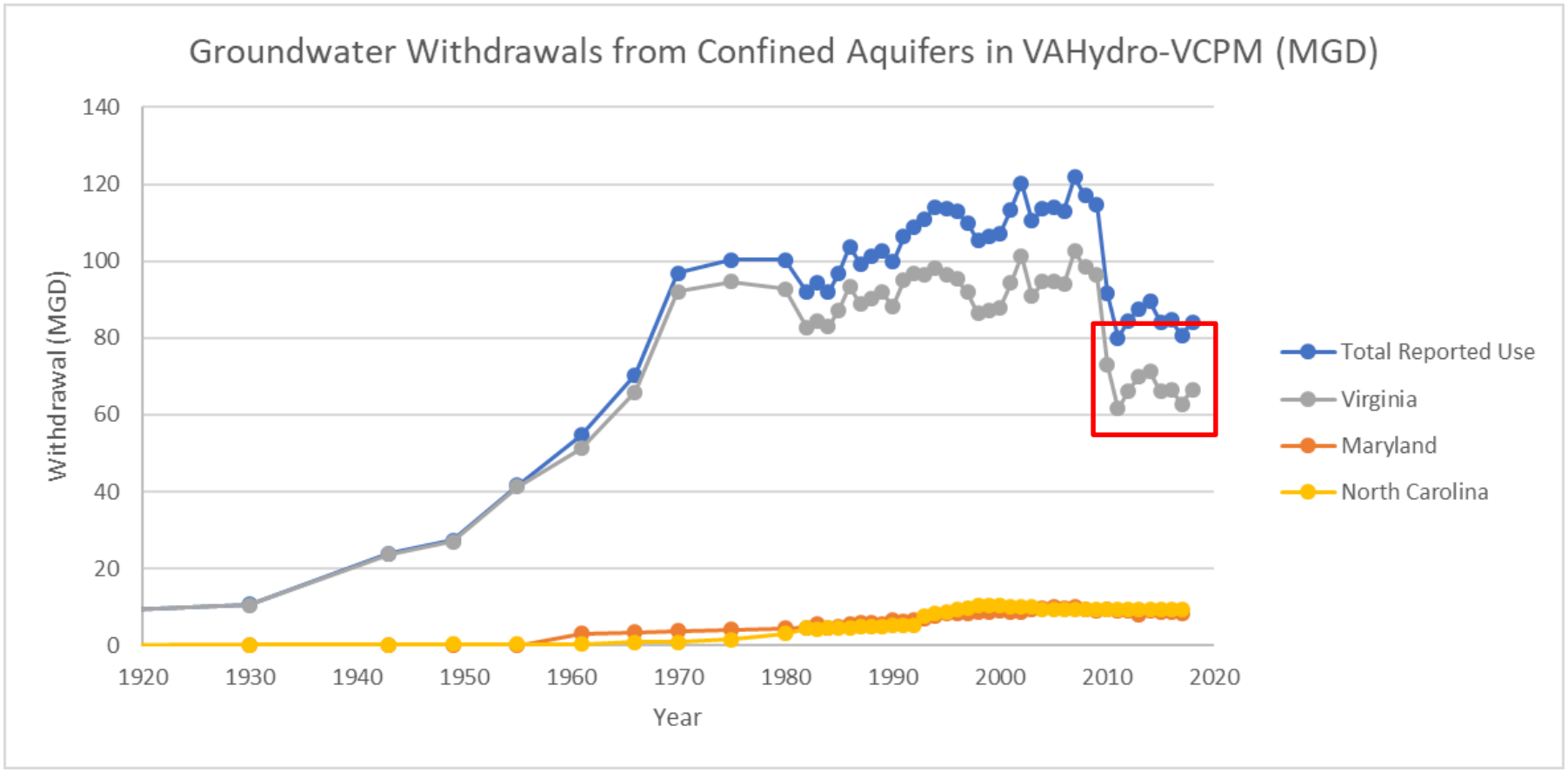

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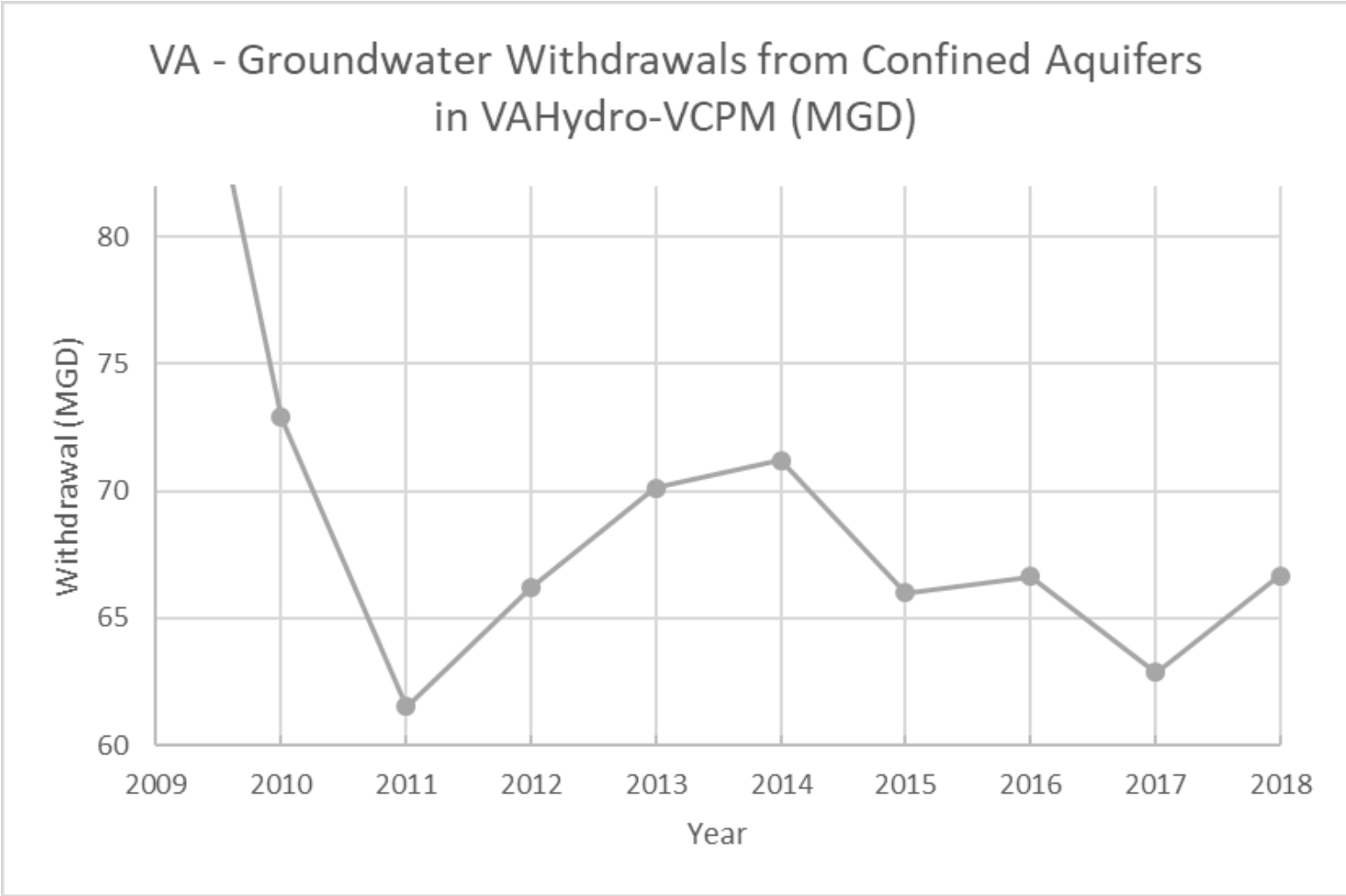

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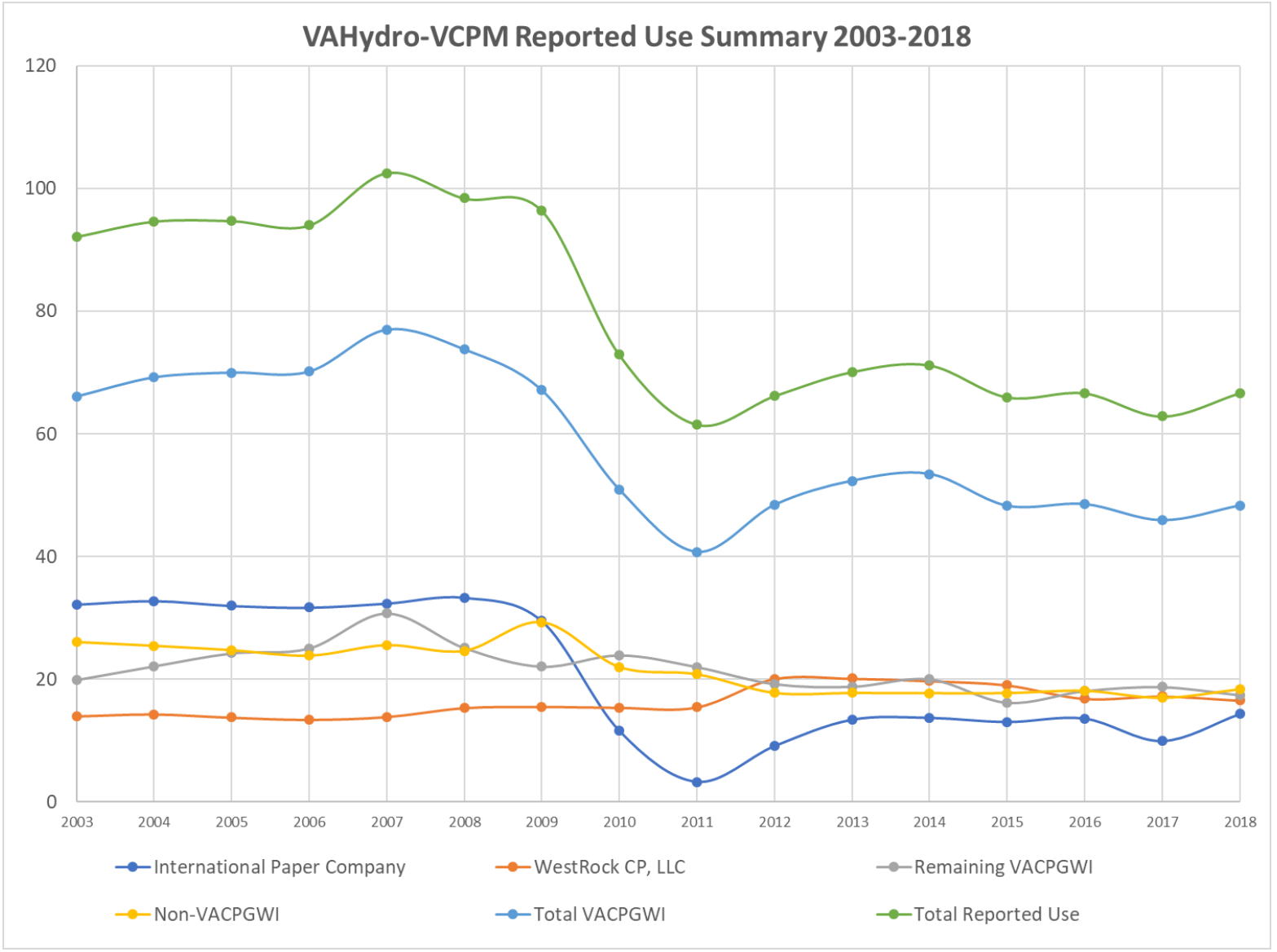

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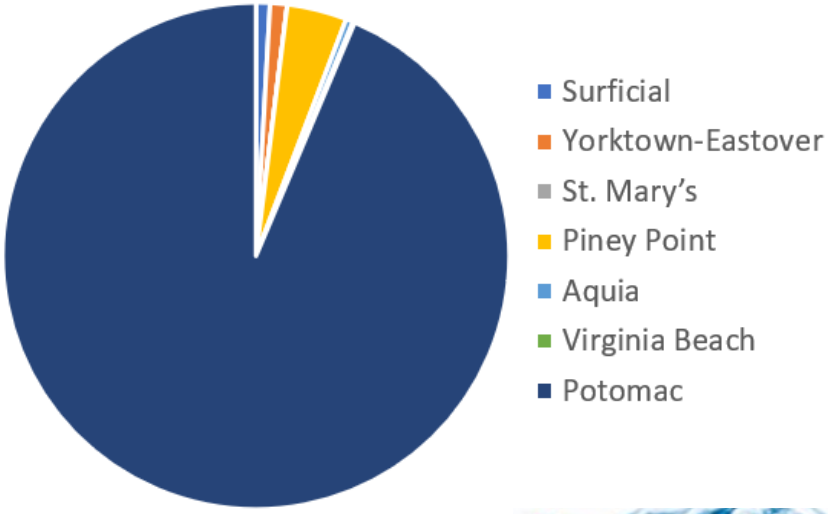
VCPM – Reported Use

Aquifer	2017 VA Reported Use (MGD)	2018 VA Reported Use (MGD)	2014-2018 VA Reported Use (MGD)	Use Allocated to Model (%)
Surficial	0.50	0.61	0.66	0.99%
Yorktown-Eastover	0.76	0.8	0.84	1.26%
St. Mary's	0	0	0	0.00%
Piney Point	3.25	2.62	2.43	3.64%
Aquia	0.23	0.29	0.36	0.54%
Virginia Beach	0.07	0.13	0.13	0.19%
Potomac	58.07	59.19	62.3	93.38%
TOTAL	**62.88**	**63.63**	**66.71**	**100.00%**



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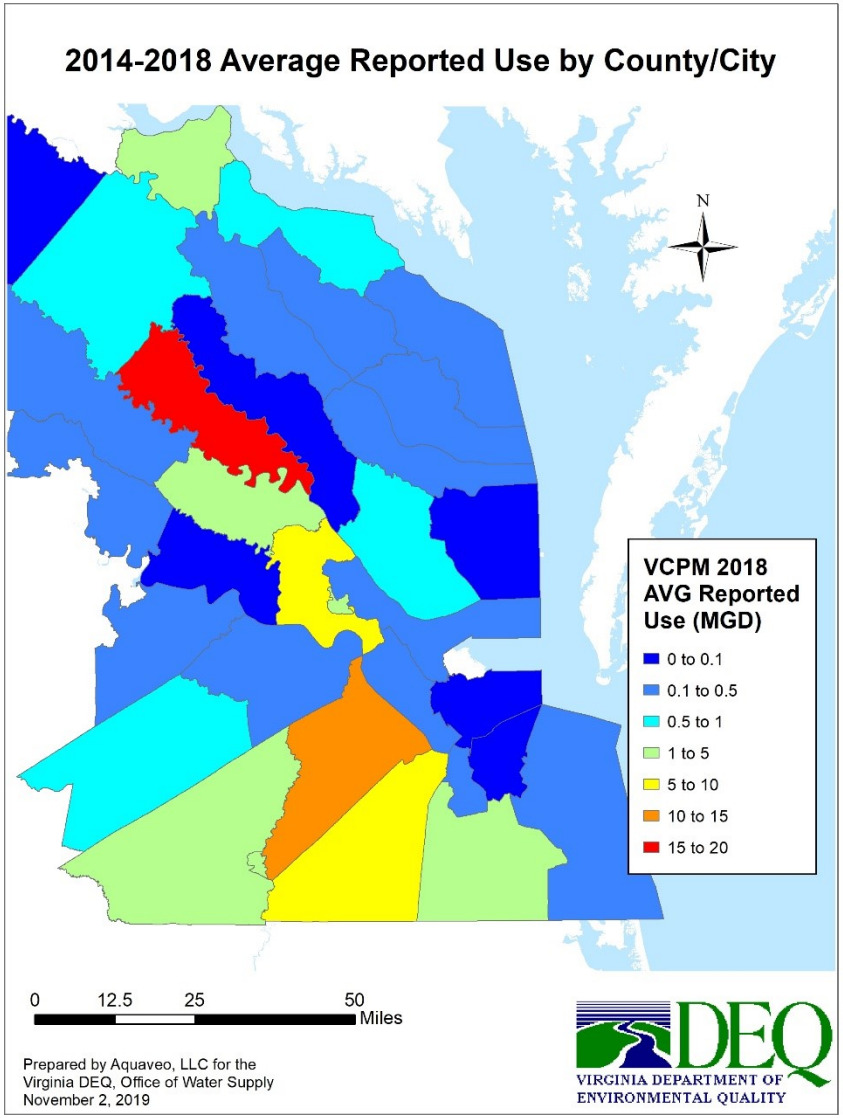
VCPM – Reported Use



City/County	2014-2018 Average Reported Use Allocated to Model (MGD)	Use Allocated to Model (%)
Caroline	0.92	1.38%
Charles City	0.06	0.09%
City of Chesapeake	1.98	2.97%
Chesterfield	0	0.00%
Essex	0.44	0.67%
Franklin City	3.37	5.05%
Gloucester	0.64	0.97%
City of Hampton	0.01	0.01%
Hanover	0.45	0.67%
Henrico	0.23	0.34%
Isle of Wight	13.61	20.41%
James City	6.08	9.13%
King and Queen	0.05	0.08%
King George	1.12	1.67%
King William	17.45	26.17%
Lancaster	0.37	0.56%
Mathews	0.01	0.01%
Middlesex	0.22	0.33%
New Kent	2.01	3.02%
City of Newport News	0.39	0.59%
City of Norfolk	0.07	0.10%
Northumberland	0.34	0.52%
City of Portsmouth	0.21	0.32%
Prince George	0.31	0.46%
Richmond County	0.35	0.52%
Southampton	3.45	5.18%
Spotsylvania	0.03	0.04%
City of Suffolk	8.48	12.73%
Surry	0.5	0.76%
Sussex	0.82	1.23%
City of Virginia Beach	0.18	0.28%
Westmoreland	0.85	1.28%
City of Williamsburg	1.24	1.86%
York	0.42	0.64%
TOTAL	**66.67**	**100.00%**

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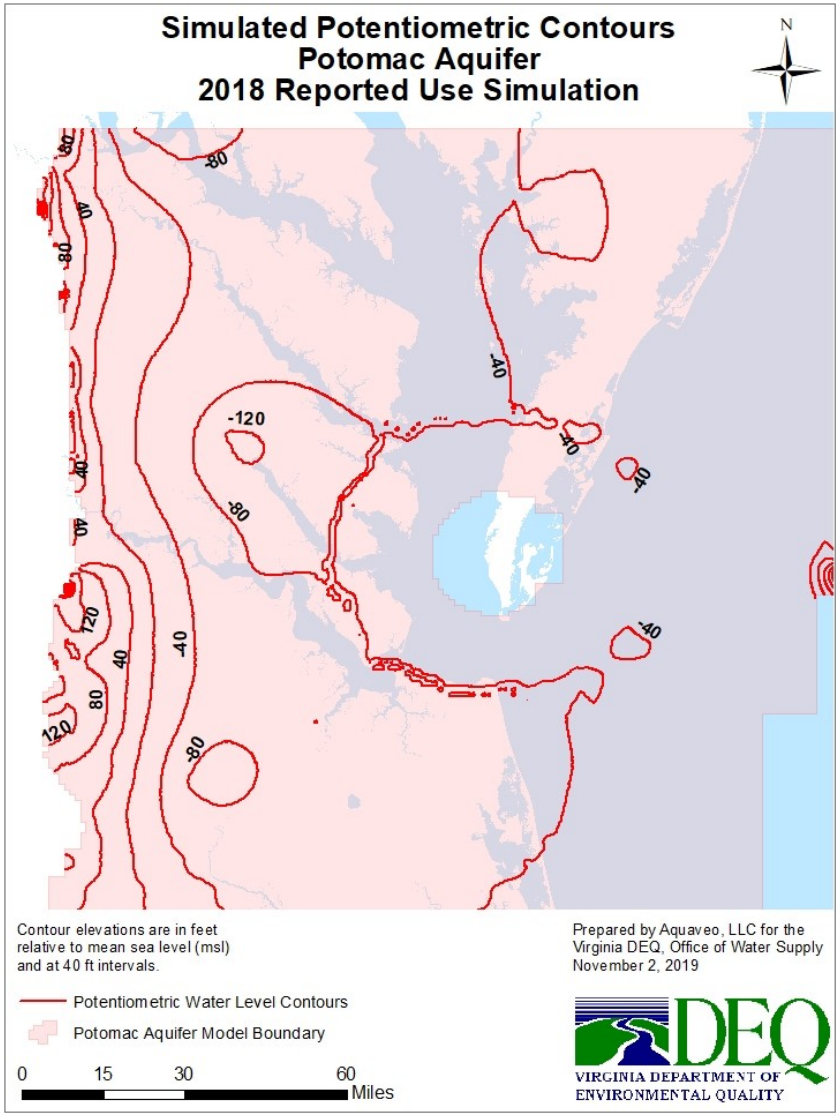
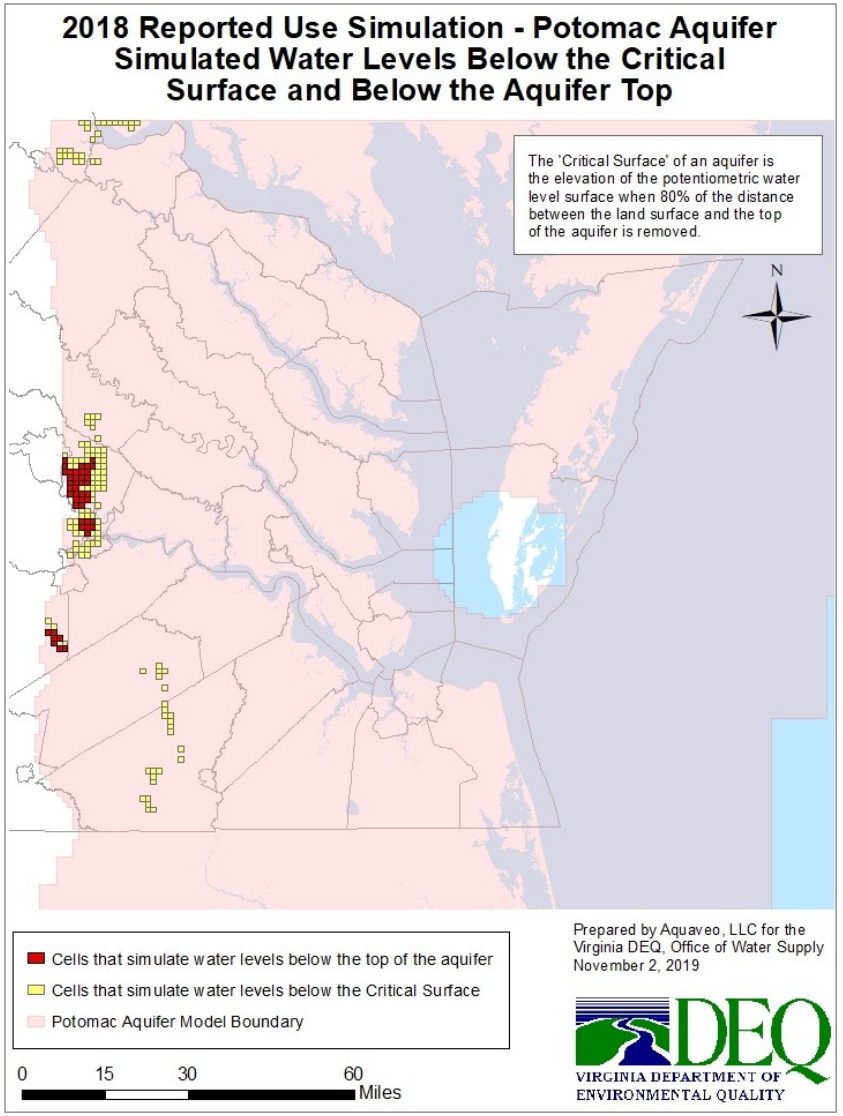
VCPM – Reported Use





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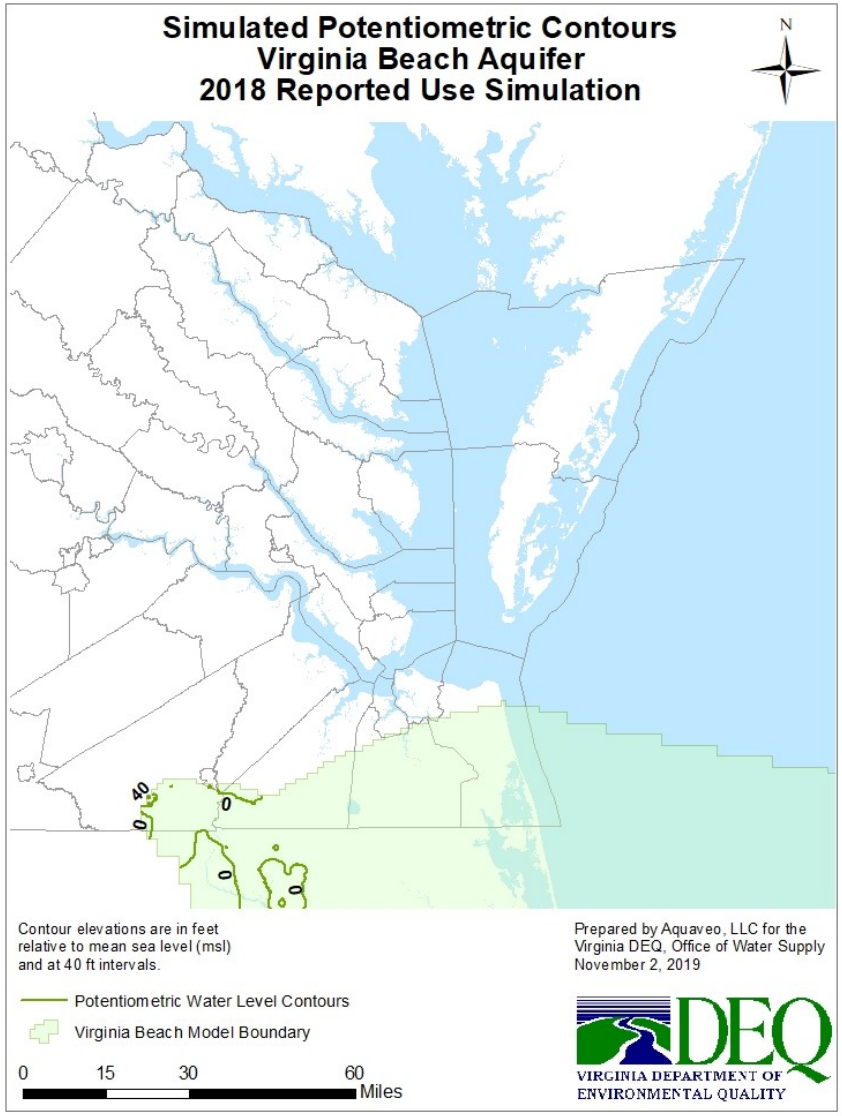

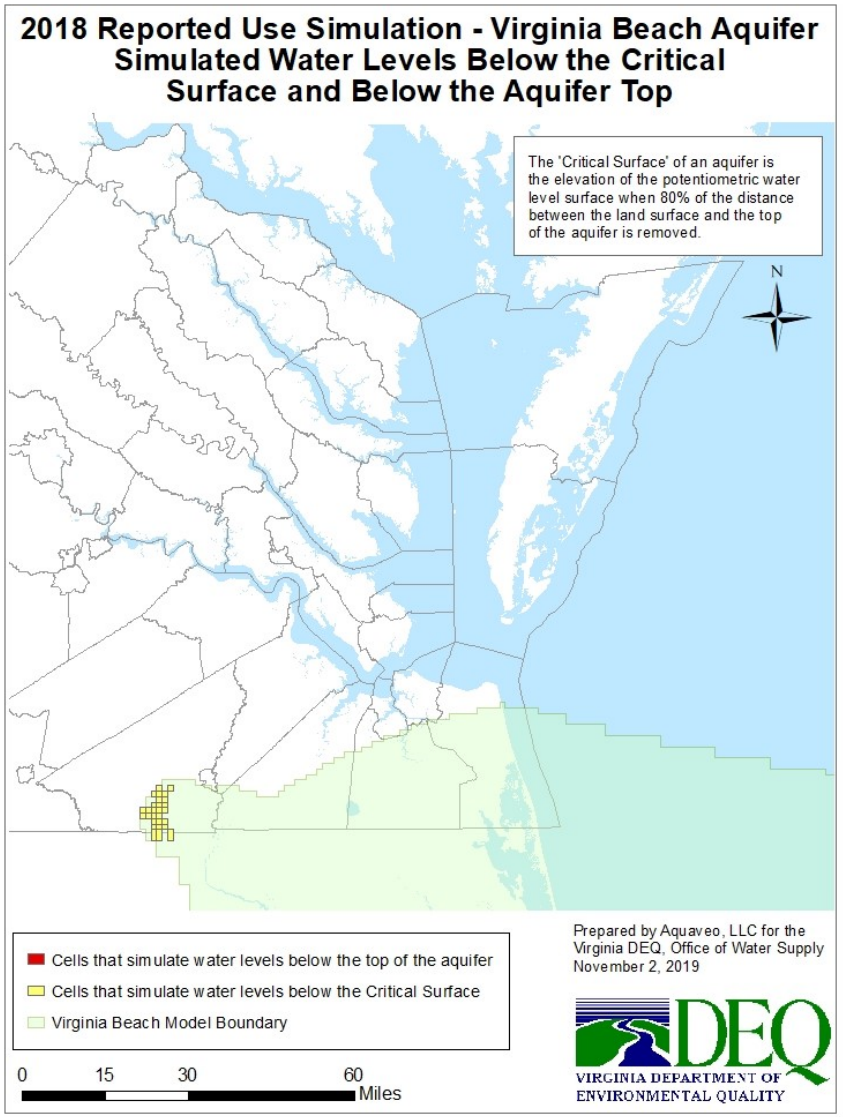

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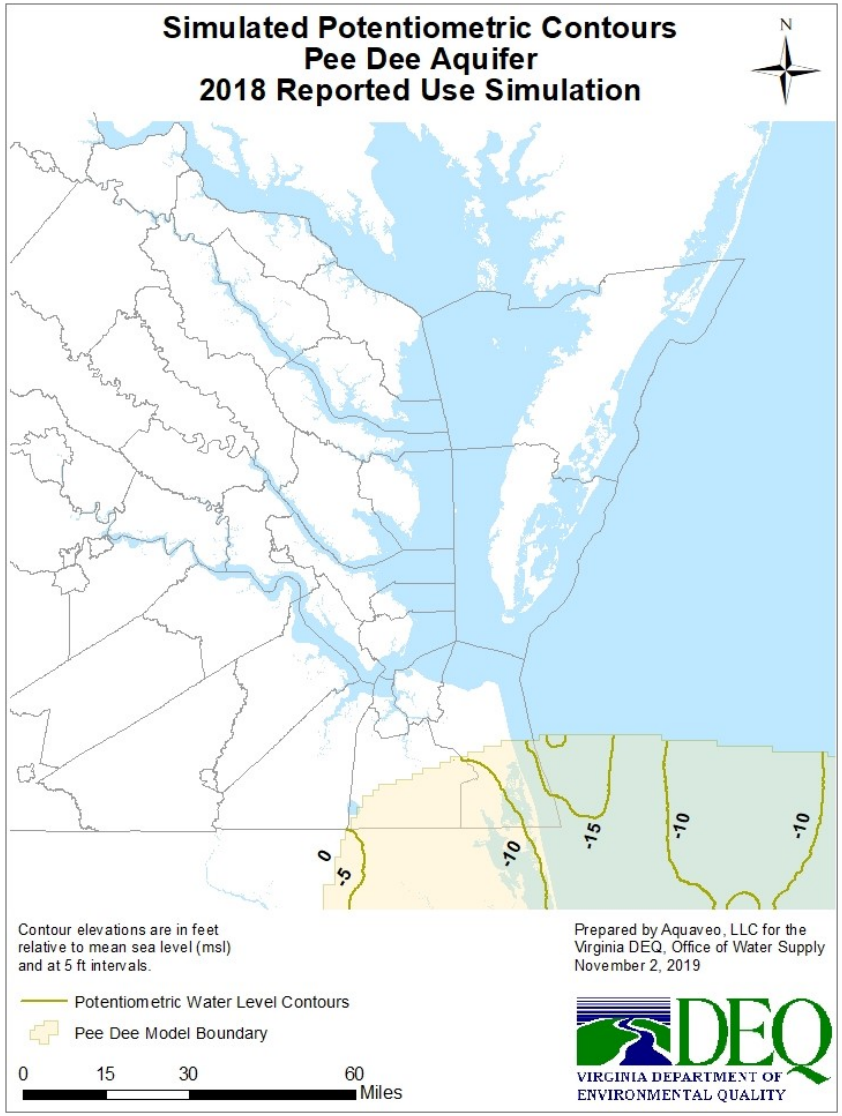

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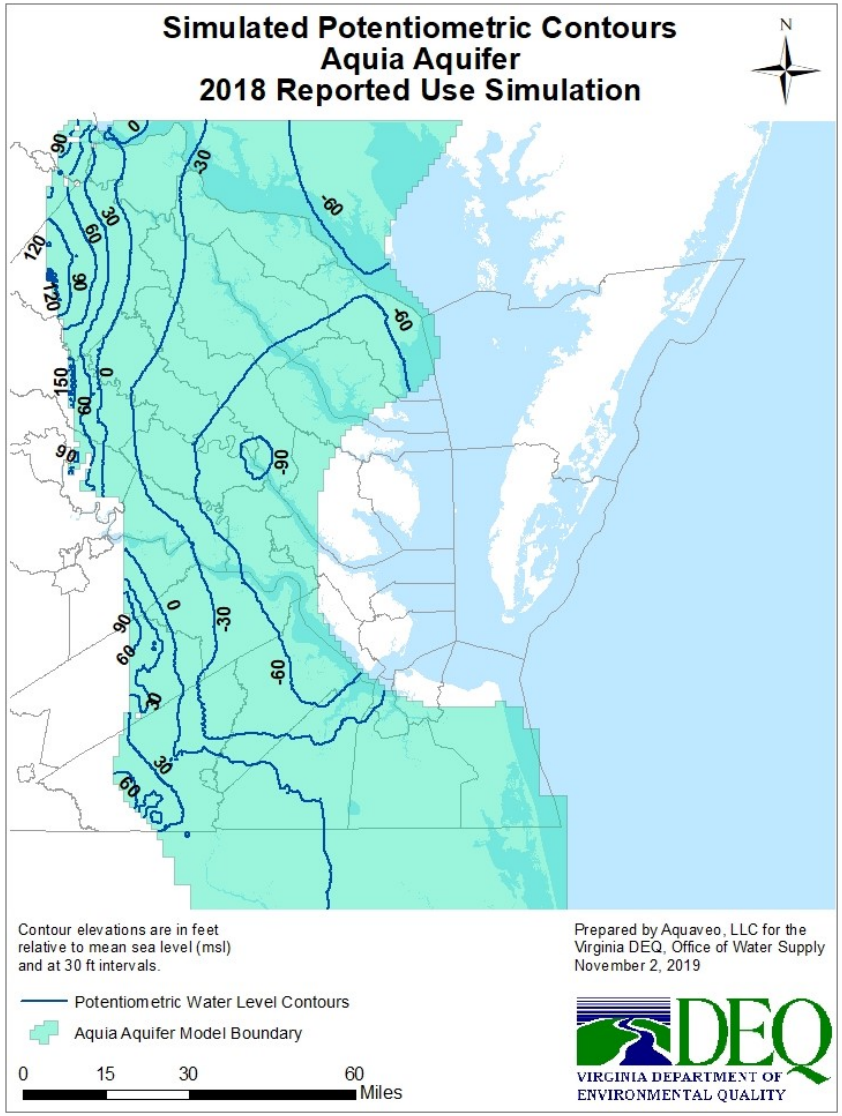

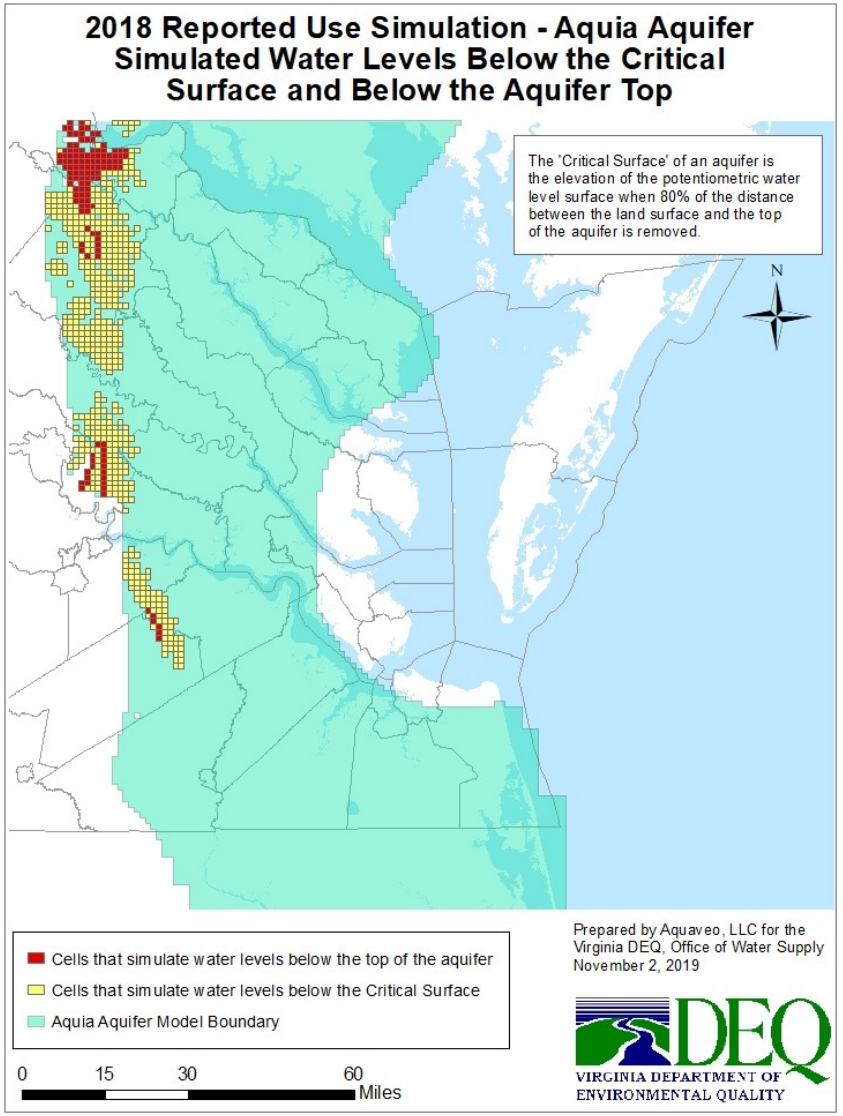

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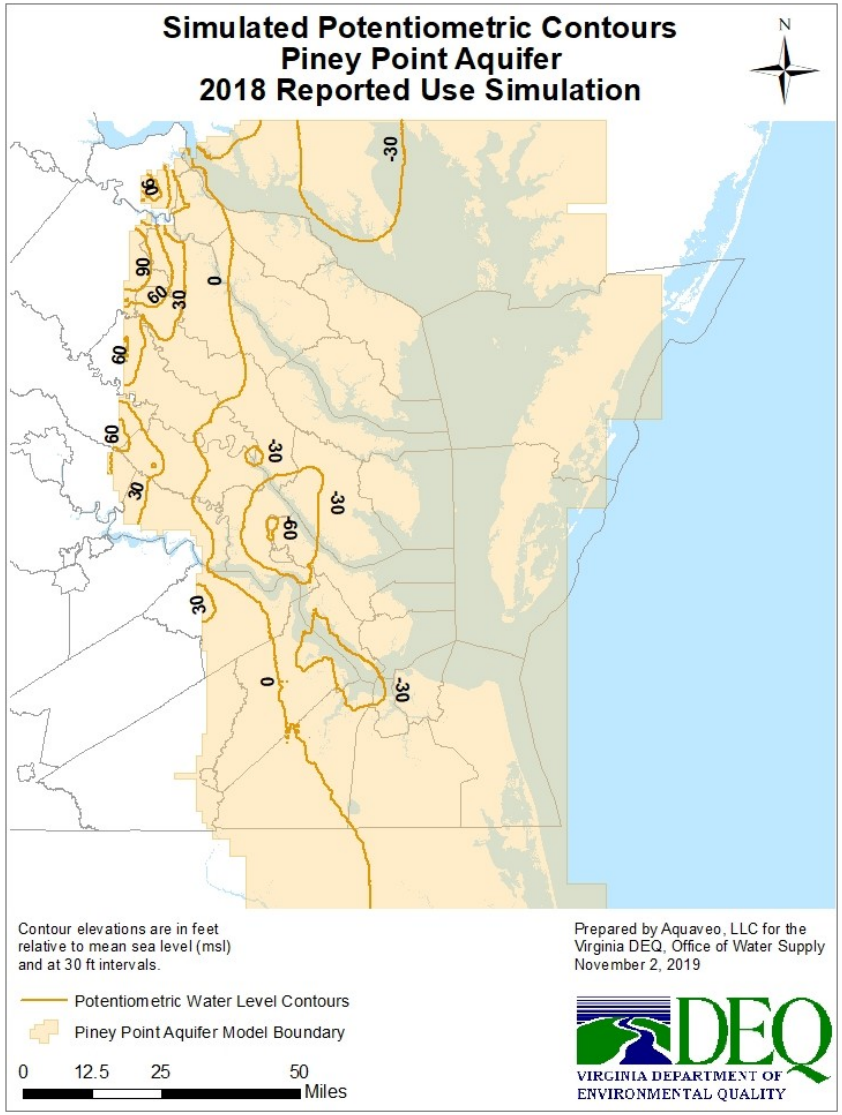

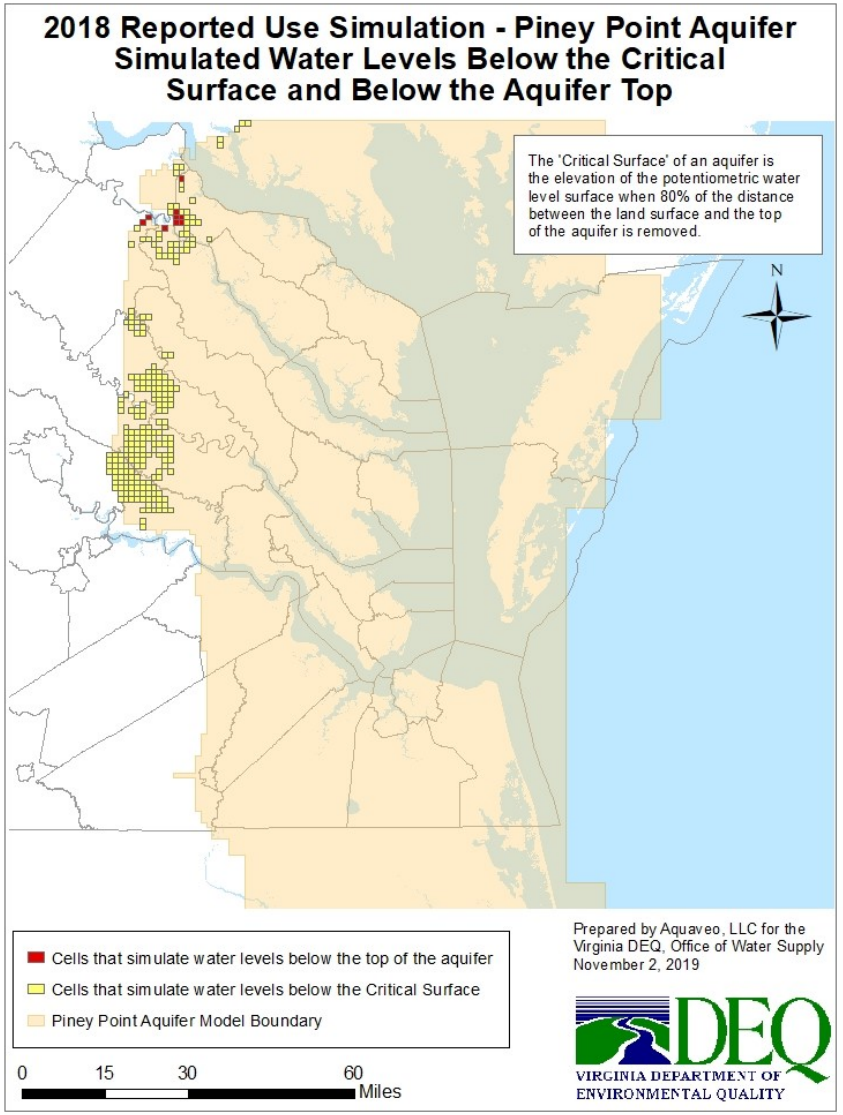

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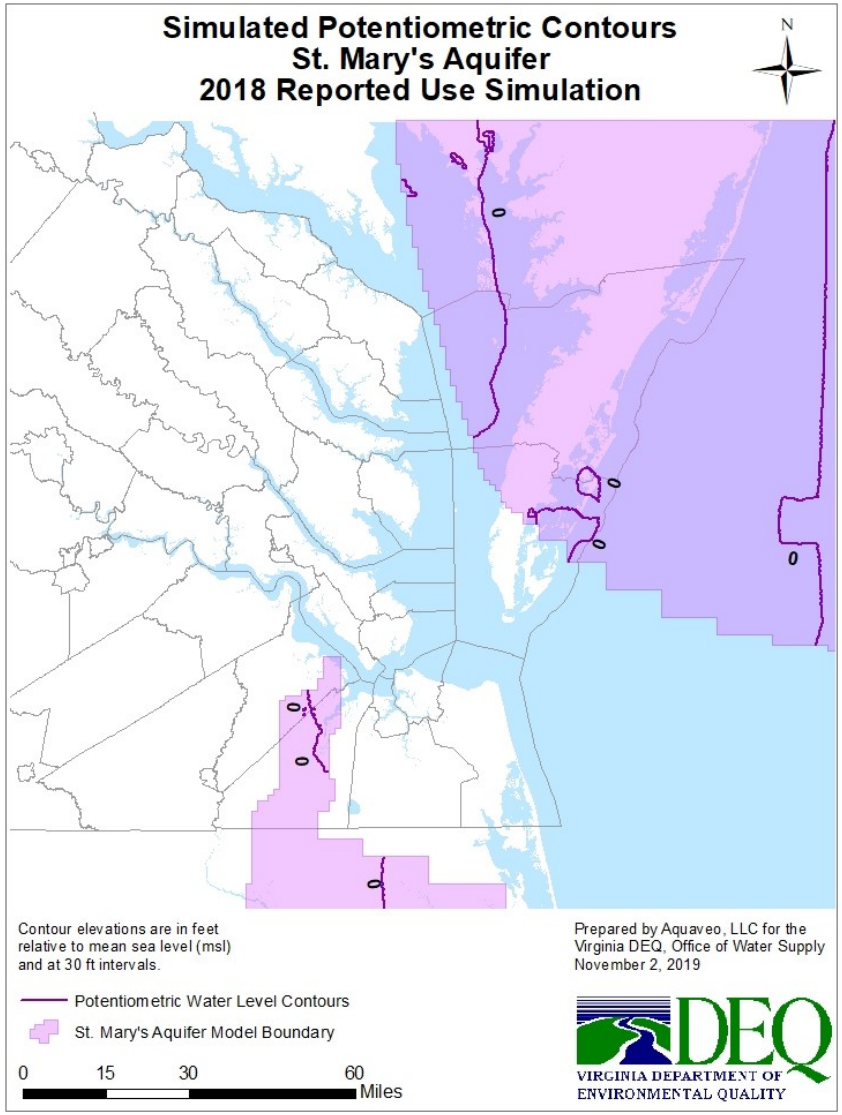
VCPM – Reported Use



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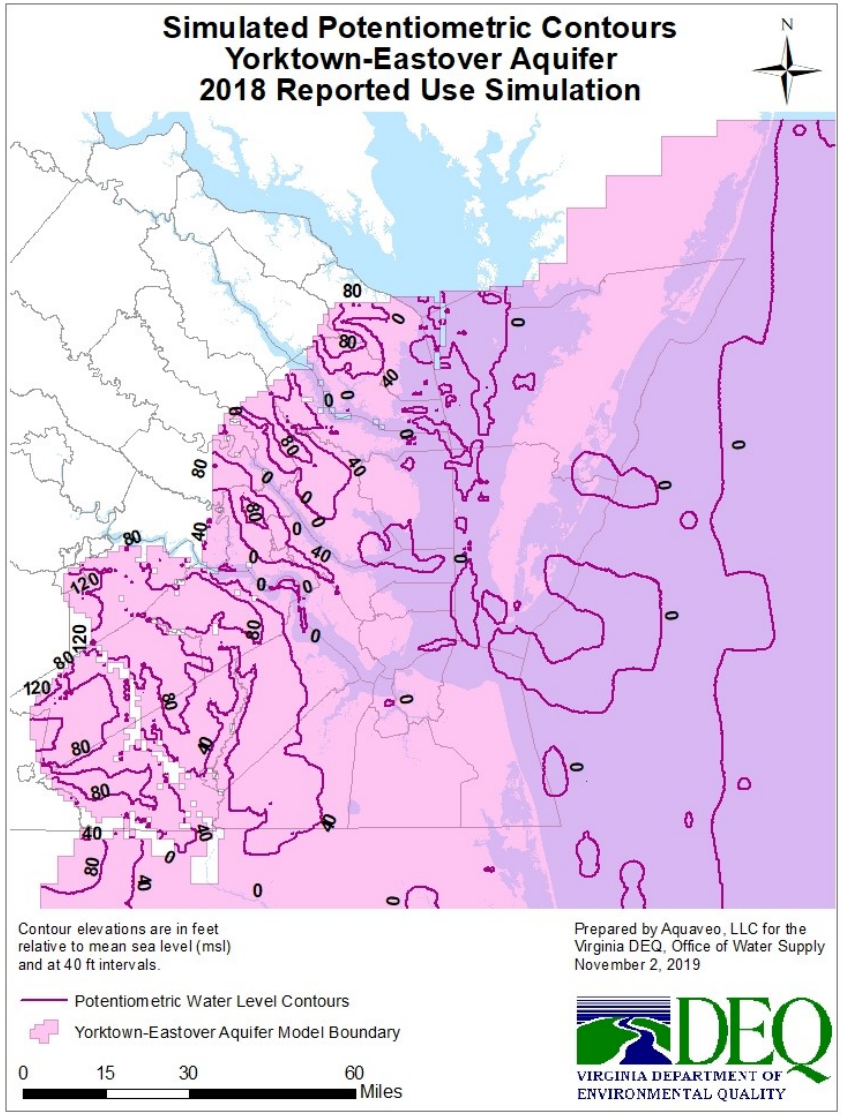
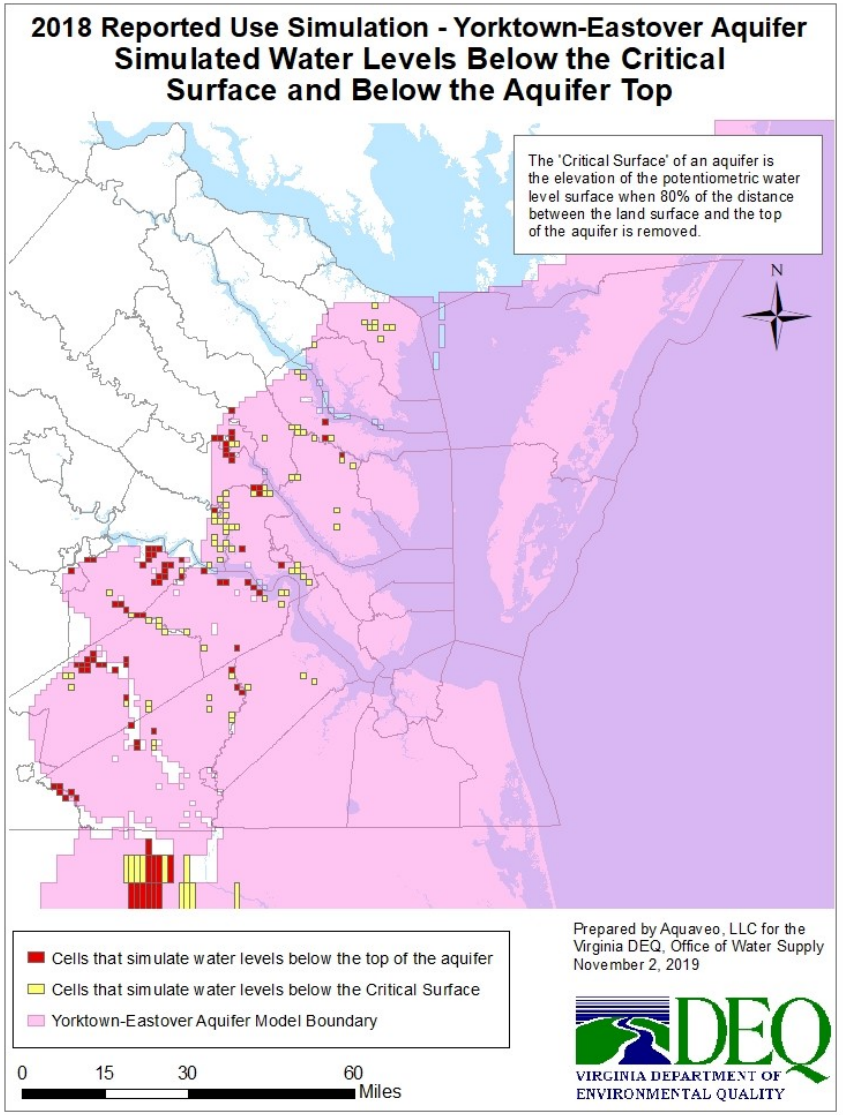
VCPM – Reported Use





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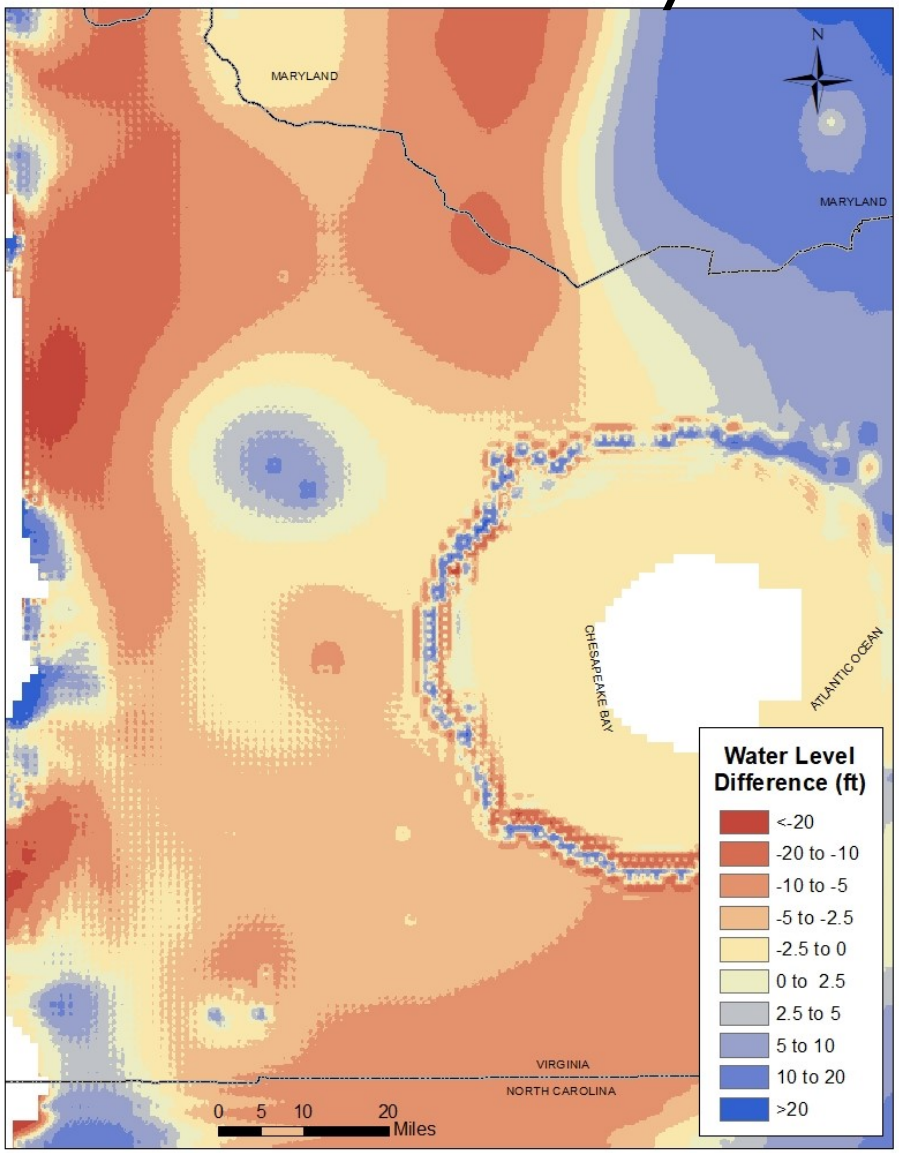
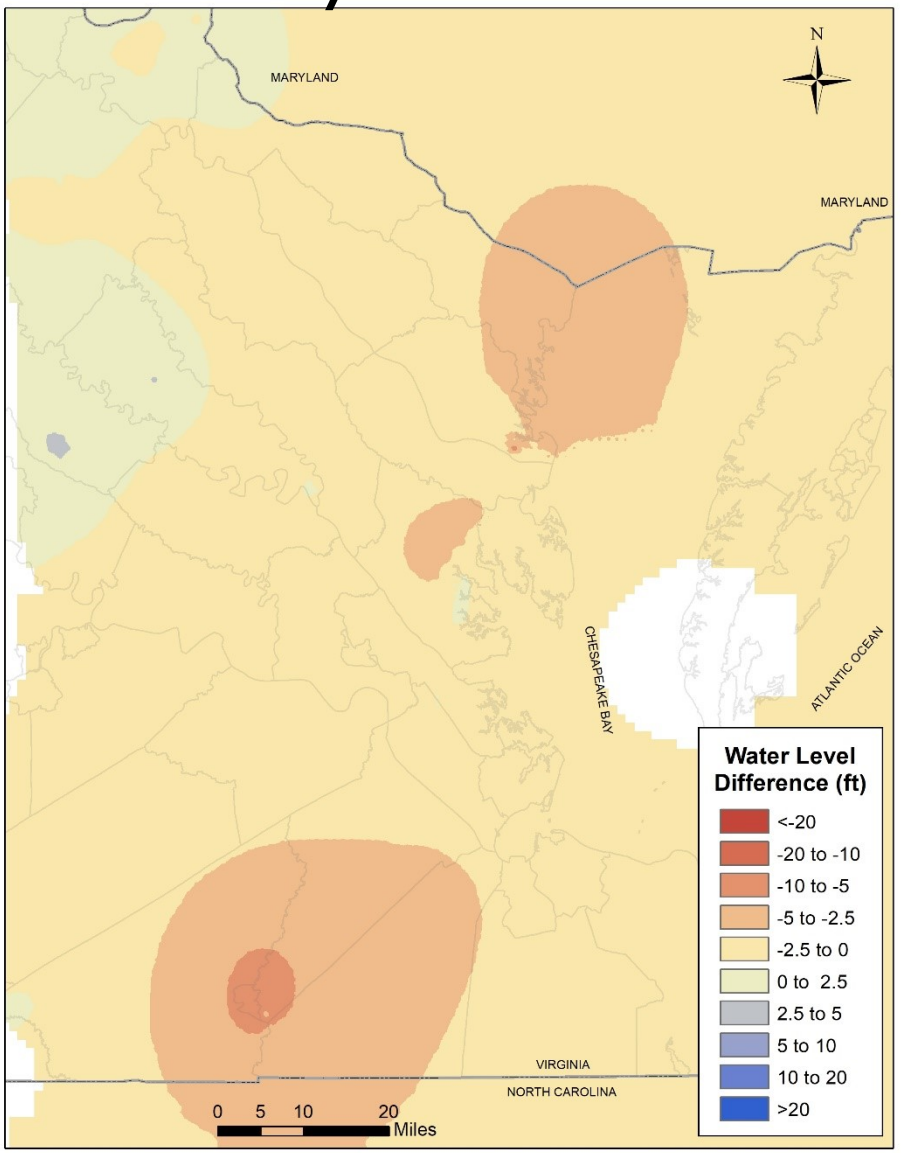
RU Simulations – Potomac

2018 minus 2017



2017 minus 2016



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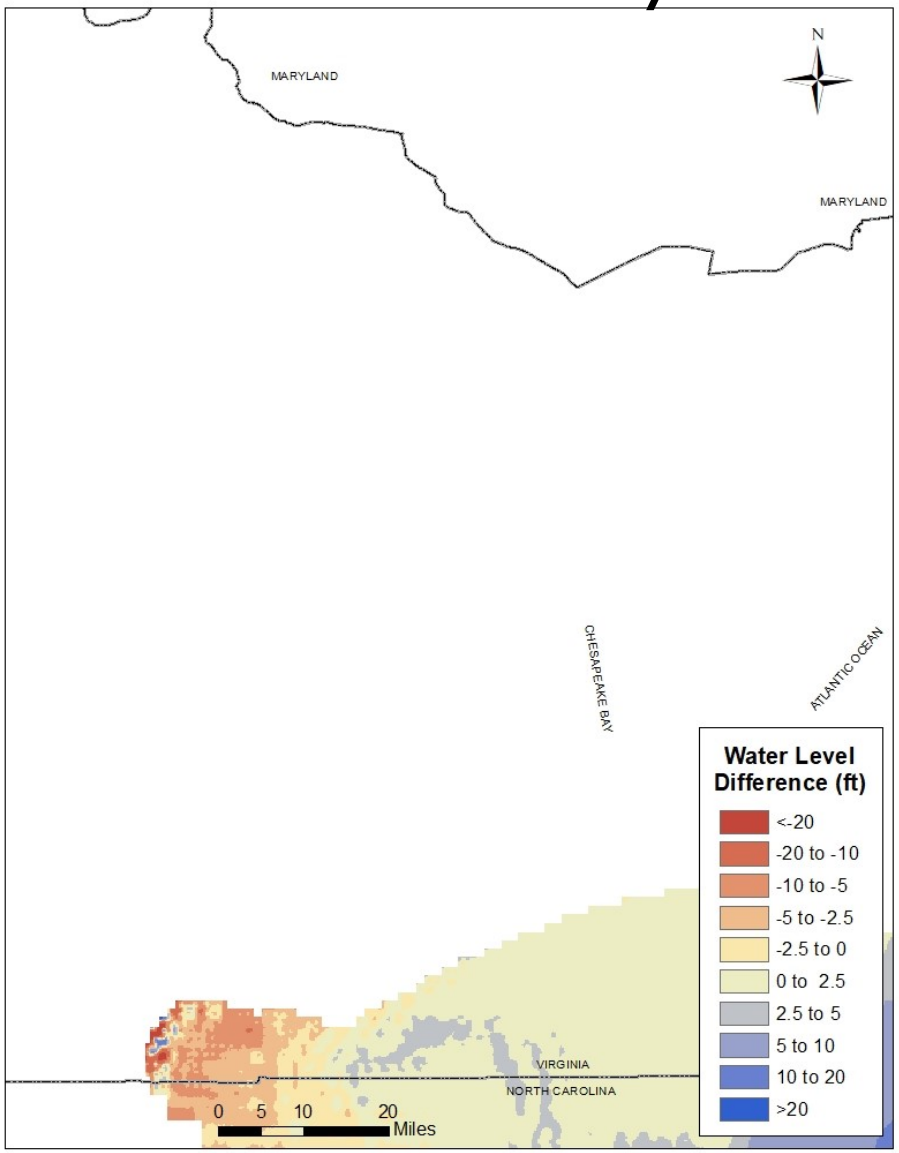
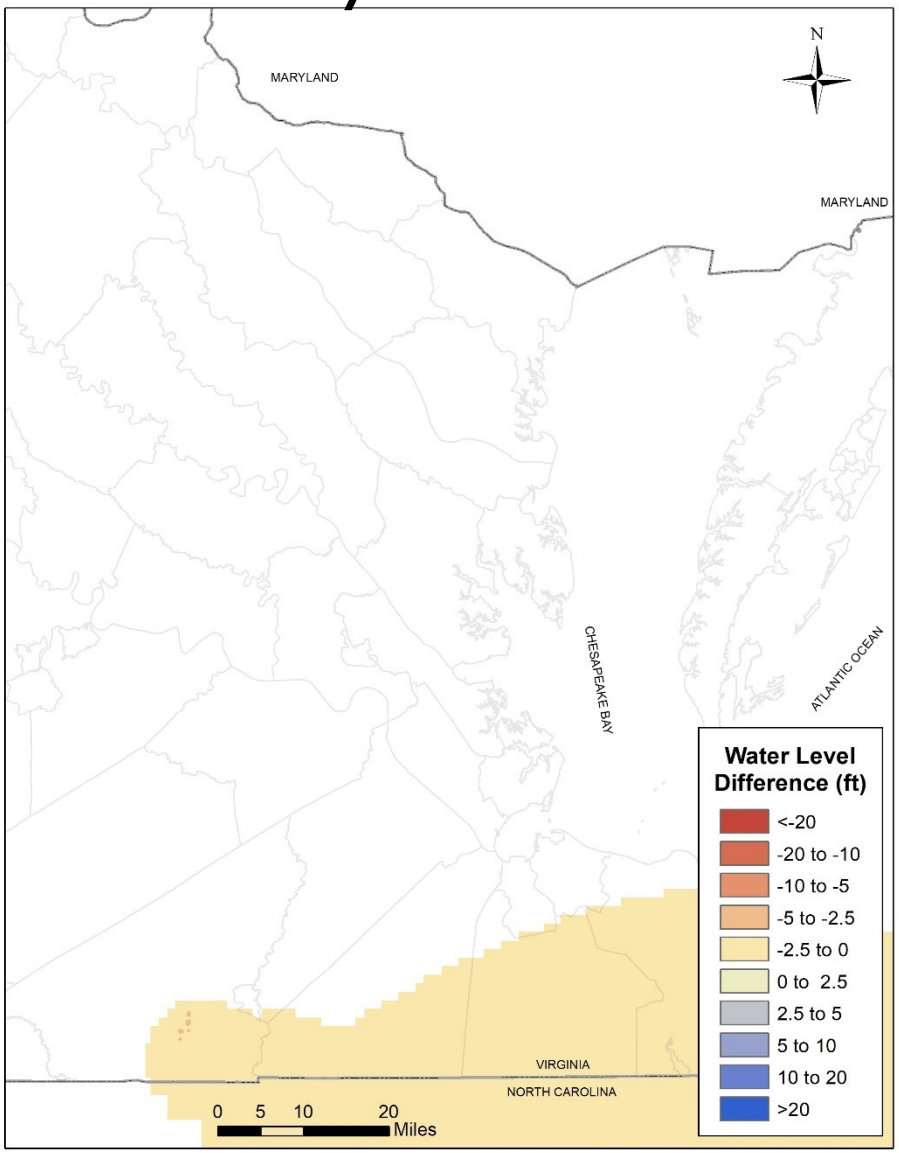
RU Simulations–Virginia Beach

2018 minus 2017



2017 minus 2016

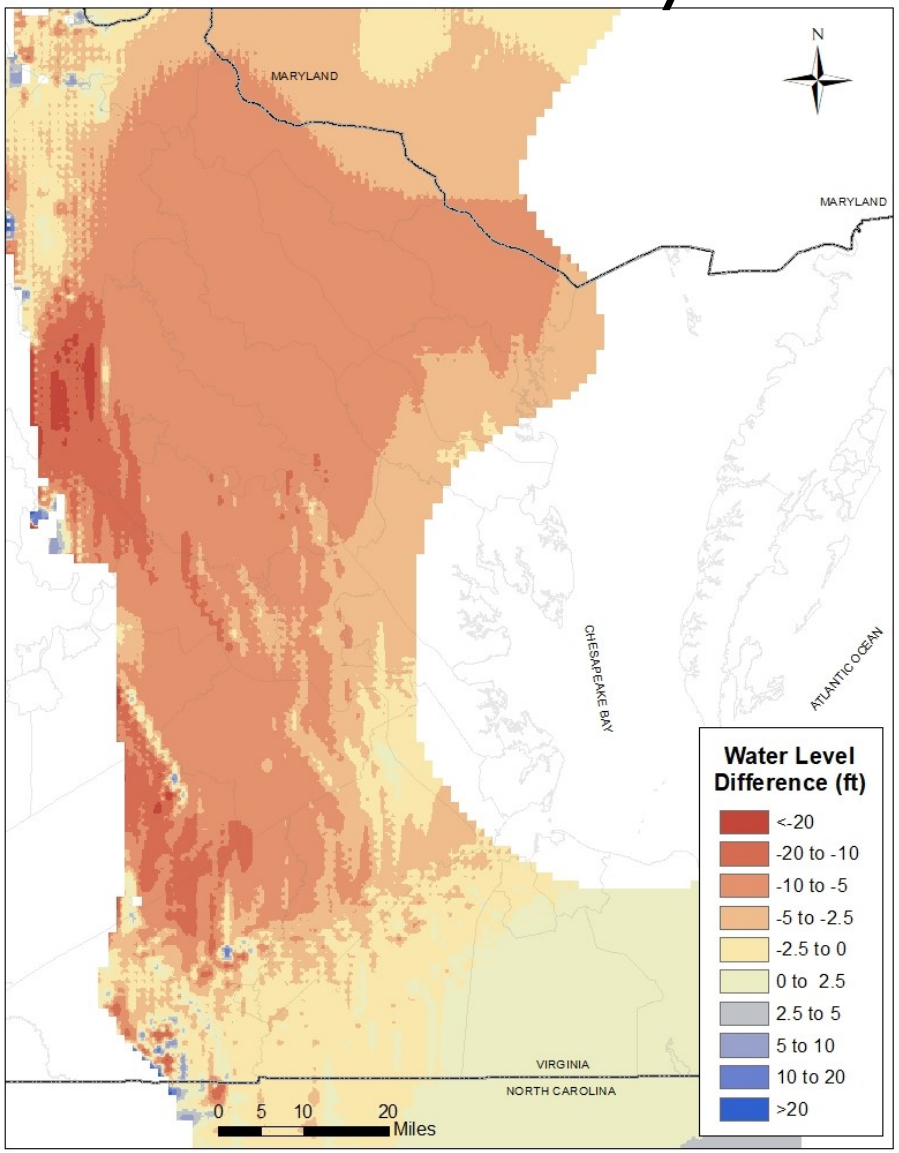


Water Modeling Solutions

DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

RU Simulations – Aquia

2018 minus 2017



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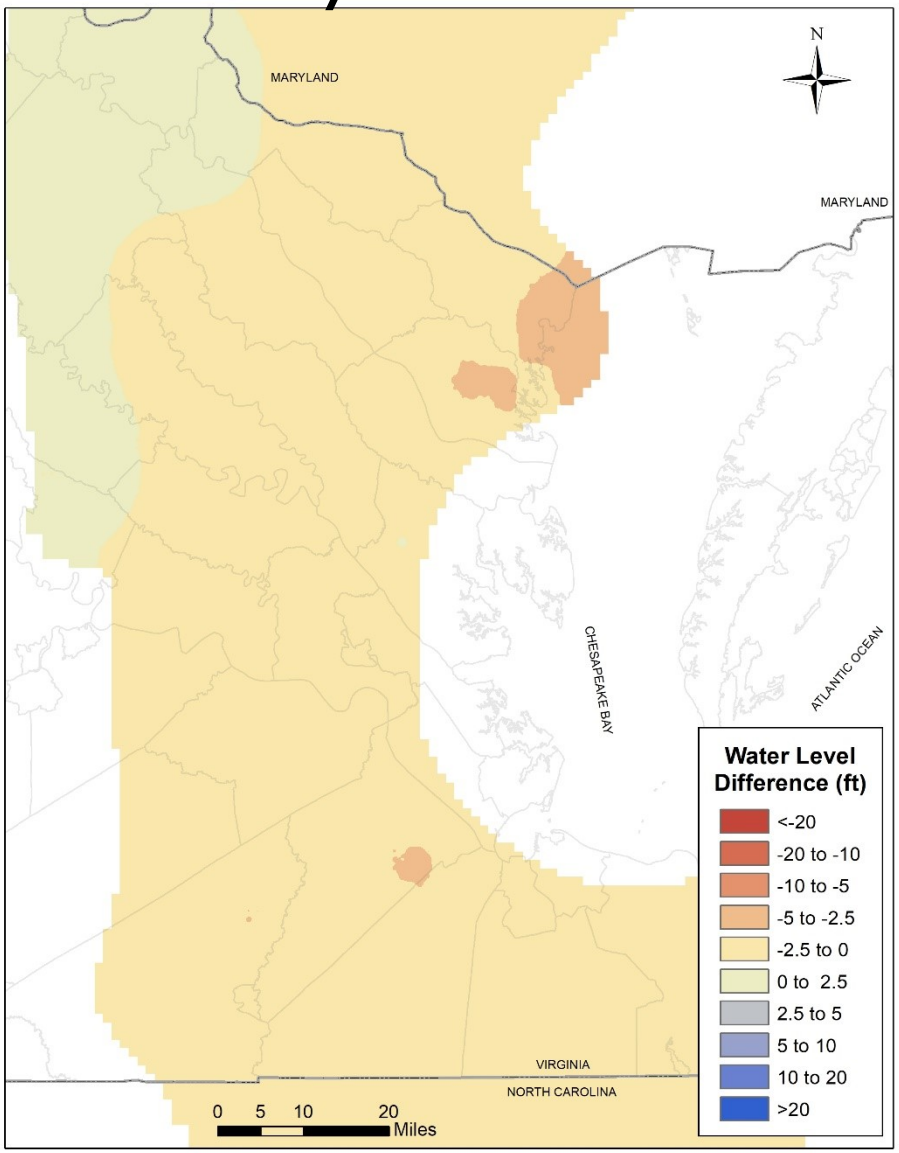
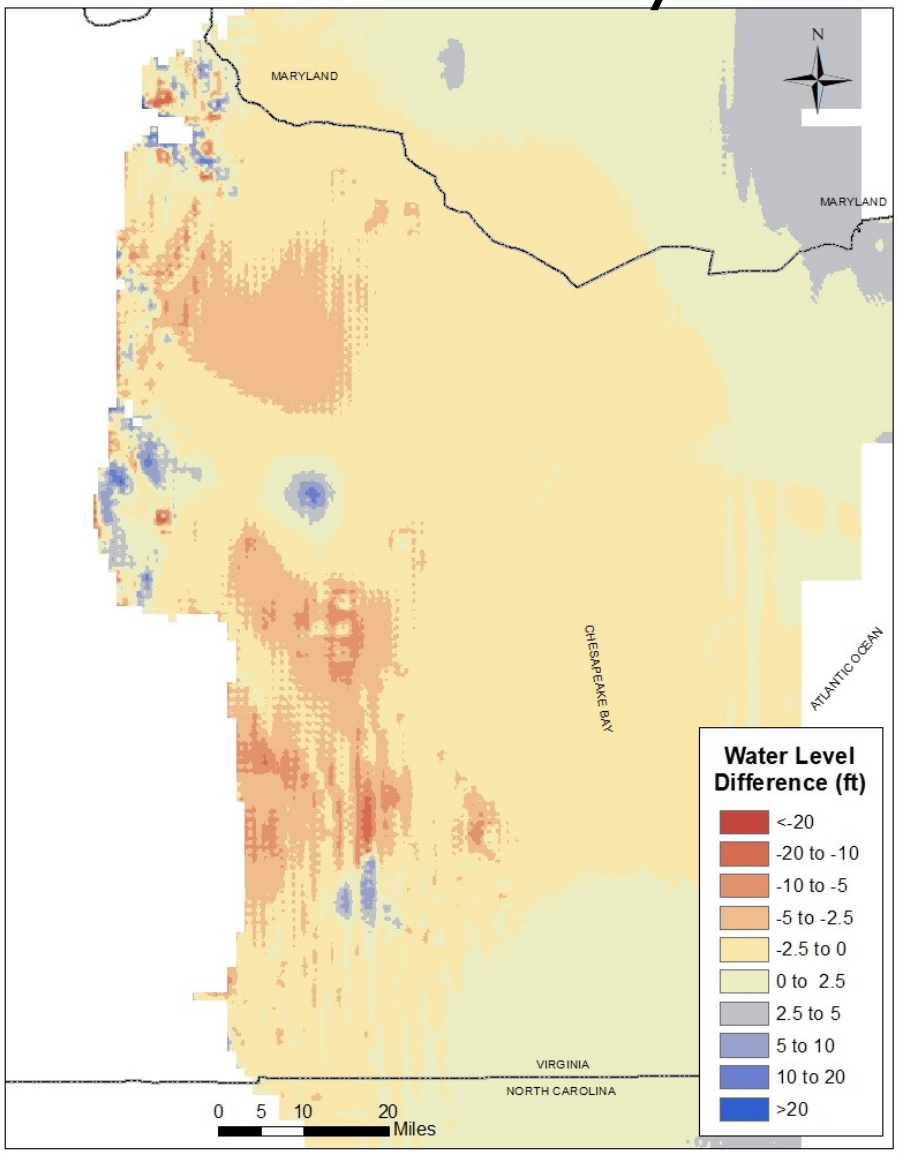


Water Modeling Solutions

DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

RU Simulations – Piney Point

2018 minus 2017



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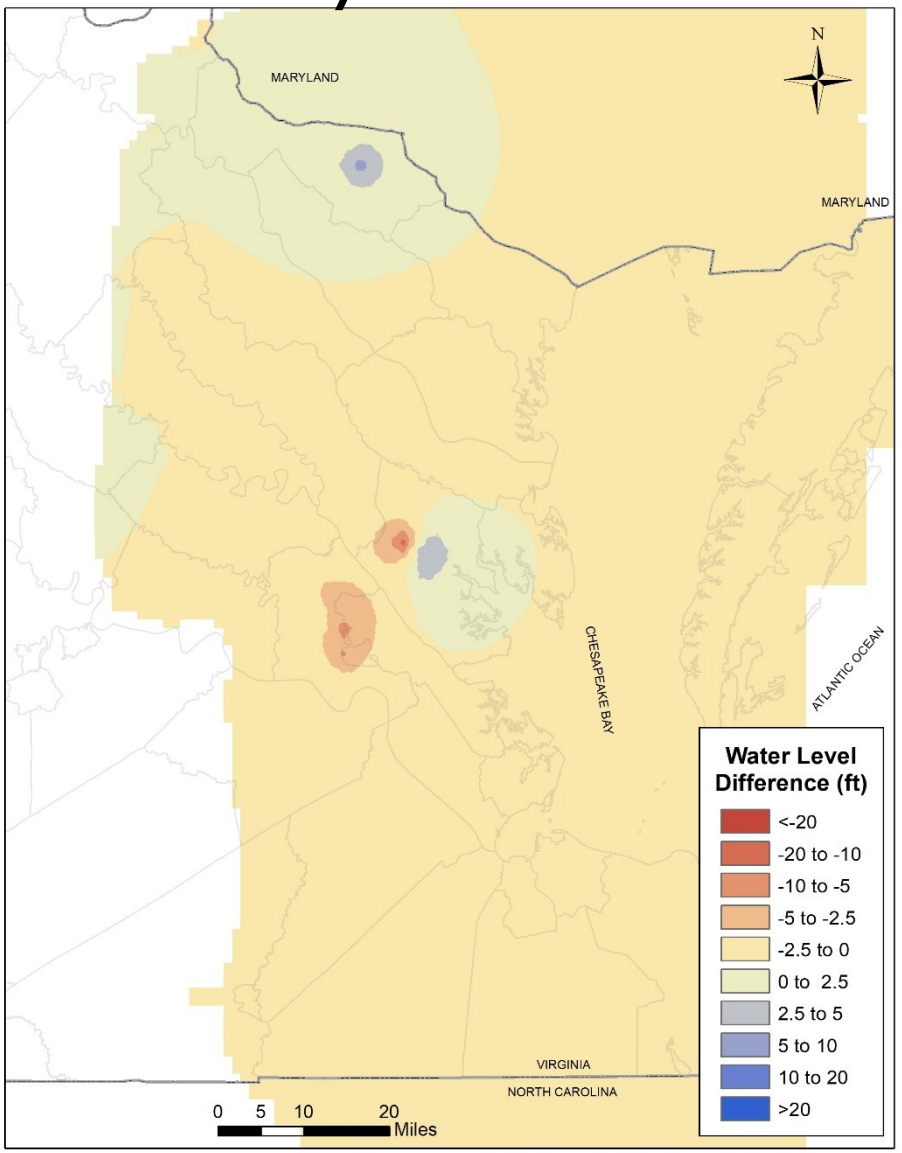
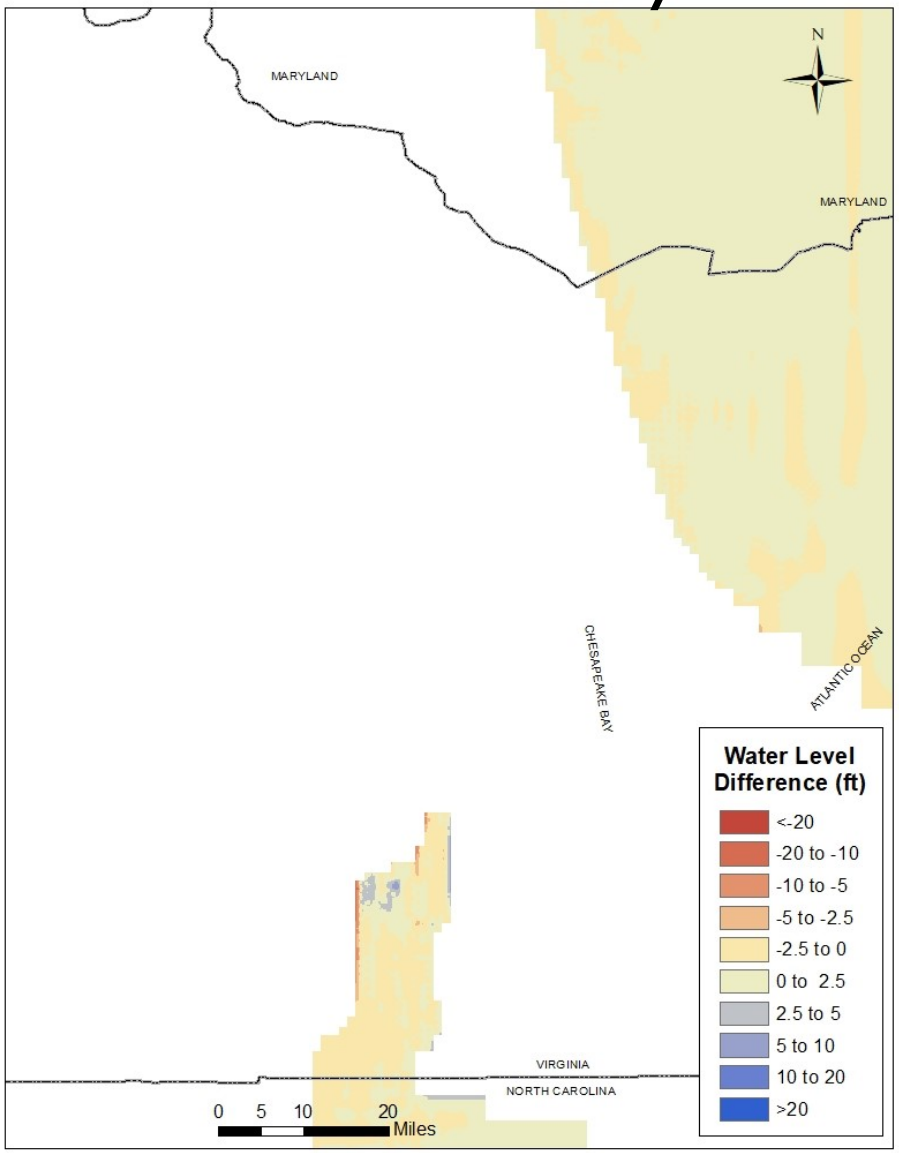


Water Modeling Solutions

DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

RU Simulations – St. Marys

2018 minus 2017



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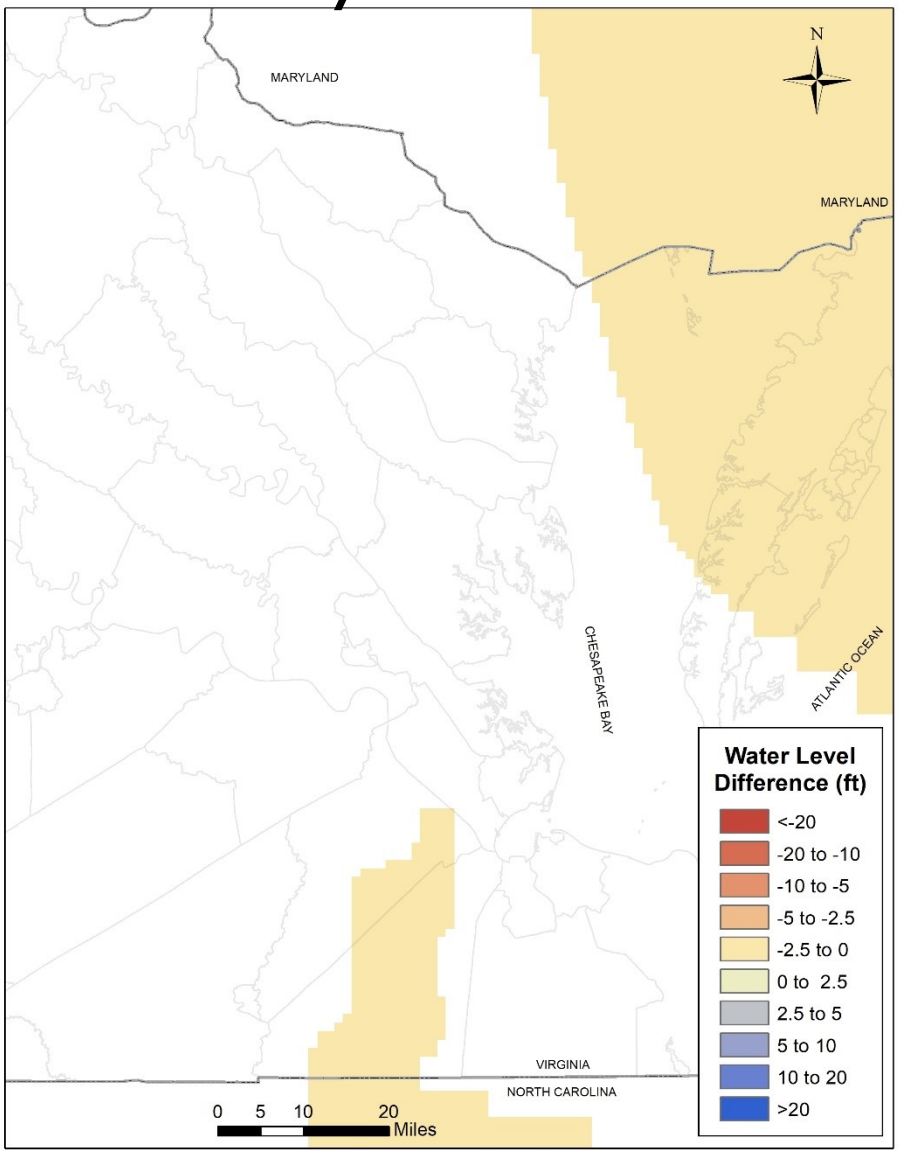
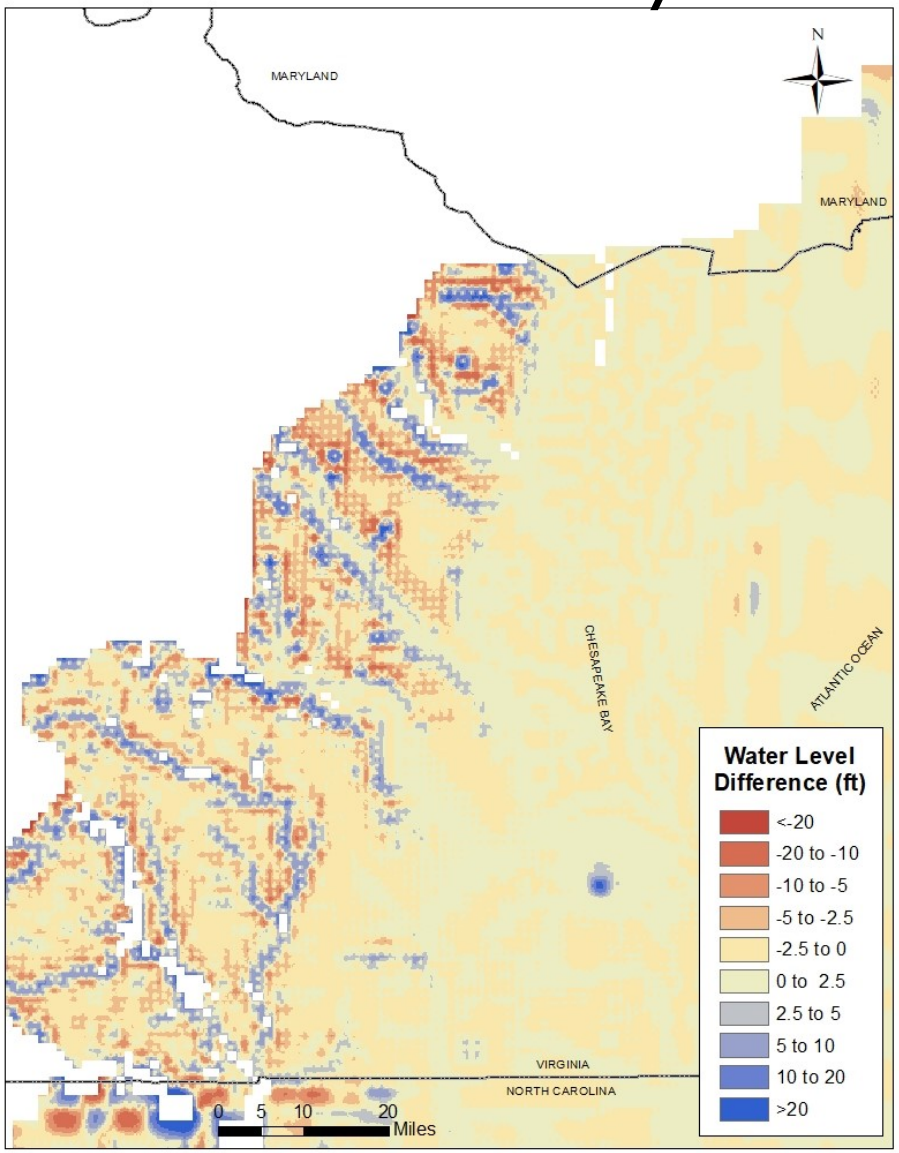


Water Modeling Solutions

DEQ
Virginia Department of Environmental Quality

RU Simulations – Yorktown

2018 minus 2017



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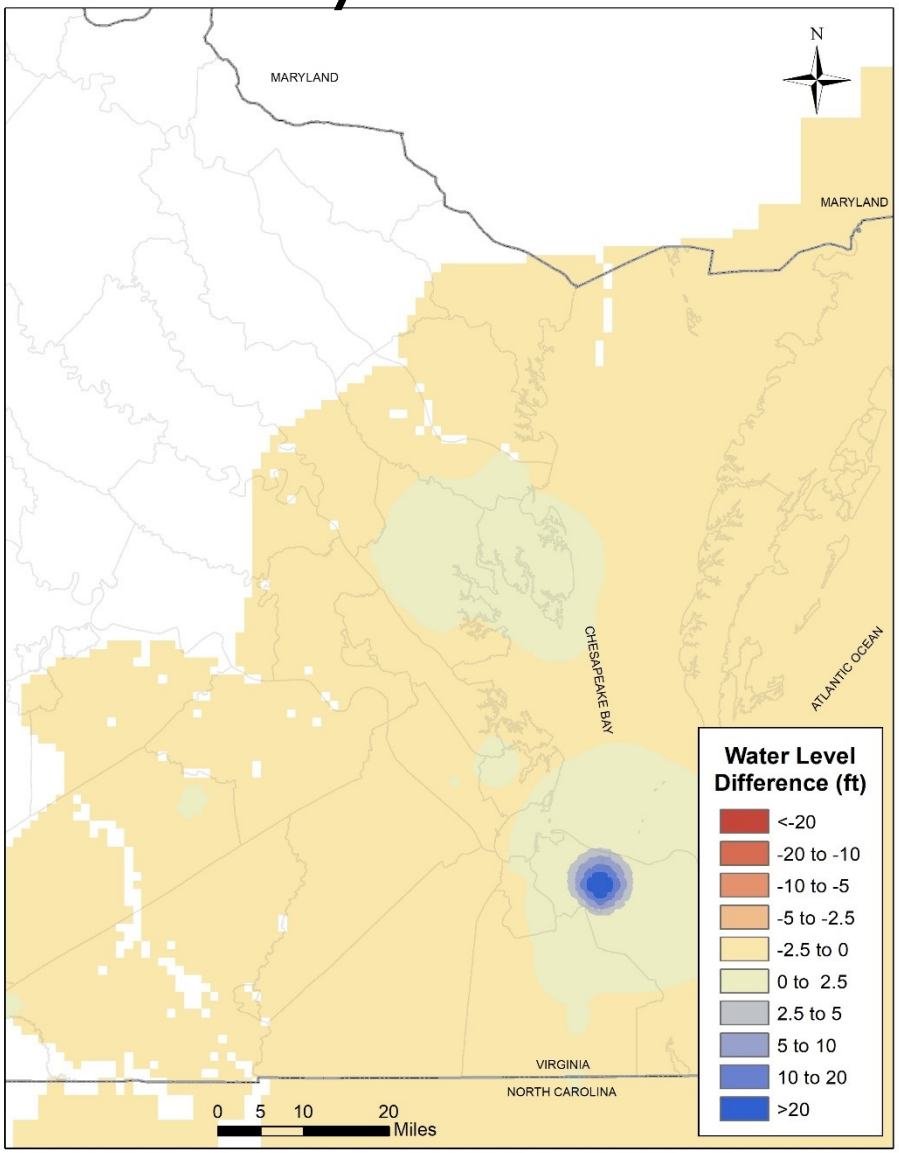


Water Modeling Solutions

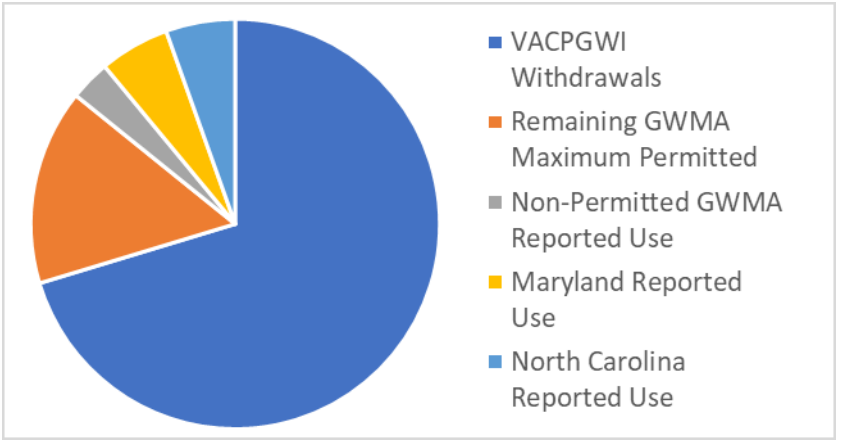
DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

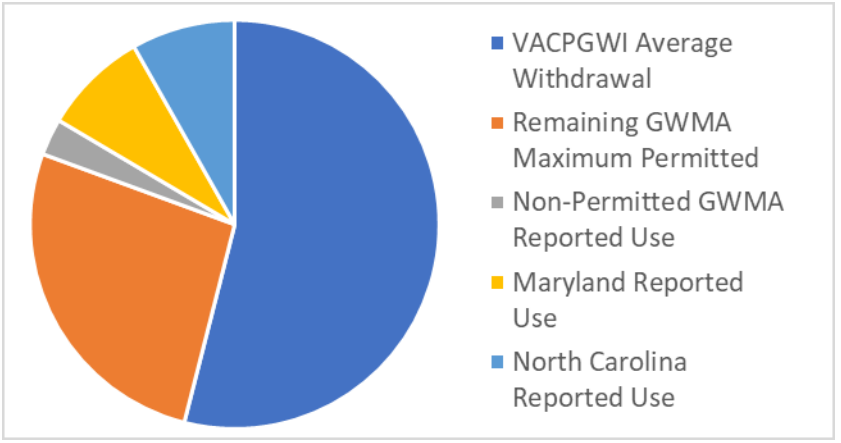
VCPM – Total Permitted

Withdrawal Source	2015 Total Permitted (MGD)	Use Allocated to Model (%)
VACPGWI Withdrawals	119.2	70.57%
Remaining GWMA Maximum Permitted	26.2	15.51%
Non-Permitted GWMA Reported Use	5.4	3.20%
Maryland Reported Use	8.8	5.21%
North Carolina Reported Use	9.3	5.51%
TOTAL	**168.9**	**100.00%**

Withdrawal Source	2018 Total Permitted (MGD)	Use Allocated to Model (%)
VACPGWI Average Withdrawal	60.9	53.85%
Remaining GWMA Maximum Permitted	31.9	28.21%
Non-Permitted GWMA Reported Use	2.8	2.48%
Maryland Reported Use	8.2	7.25%
North Carolina Reported Use	9.3	8.22%
TOTAL	**113.1**	**100.00%**

Withdrawal Source	2019 Total Permitted (MGD)	Use Allocated to Model (%)
VACPGWI Average Withdrawal	60.6	53.89%
Remaining GWMA Maximum Permitted	32.3	28.72%
Non-Permitted GWMA Reported Use	1.7	1.47%
Maryland Reported Use	8.6	7.65%
North Carolina Reported Use	9.3	8.27%
TOTAL	**112.5**	**100.00%**





Water Modeling Solutions

DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

VCPM – Total Permitted

City/County	2014-2018 Average Reported Use (MGD)	2019 Total Permitted Amount (MGD)	RU/TP
Caroline	0.92	1.20	77.0%
Charles City	0.06	0.20	30.7%
City of Chesapeake	1.98	2.46	80.5%
Chesterfield	0.0	0.0	-
Essex	0.44	0.74	59.4%
Franklin City	3.37	4.34	77.6%
Gloucester	0.64	1.01	63.6%
City of Hampton	0.01	0.26	3.8%
Hanover	0.45	0.68	65.7%
Henrico	0.23	0.25	-
Isle of Wight	13.61	22.79	59.7%
James City	6.08	9.24	65.8%
King and Queen	0.05	0.10	52.6%
King George	1.12	1.46	76.6%
King William	17.45	19.28	90.5%
Lancaster	0.37	0.48	77.4%
Mathews	0.01	0.02	46.6%
Middlesex	0.22	0.60	36.5%
New Kent	2.01	4.39	45.8%
City of Newport News	0.39	5.03	7.8%
City of Norfolk	0.07	0.09	74.8%
Northumberland	0.34	0.58	58.9%
City of Portsmouth	0.21	1.39	15.1%
Prince George	0.31	0.57	54.4%
Richmond County	0.35	0.40	87.4%
Southampton	3.45	5.56	62.1%
Spotsylvania	0.03	0.02	153.7%
City of Suffolk	8.48	15.97	53.1%
Surry	0.5	0.71	70.5%
Sussex	0.82	1.54	53.4%
City of Virginia Beach	0.18	0.53	33.7%
Westmoreland	0.85	1.38	61.6%
City of Williamsburg	1.24	1.48	83.6%
York	0.42	0.58	72.4%
TOTAL	**66.7**	**105.3**	**63.3%**

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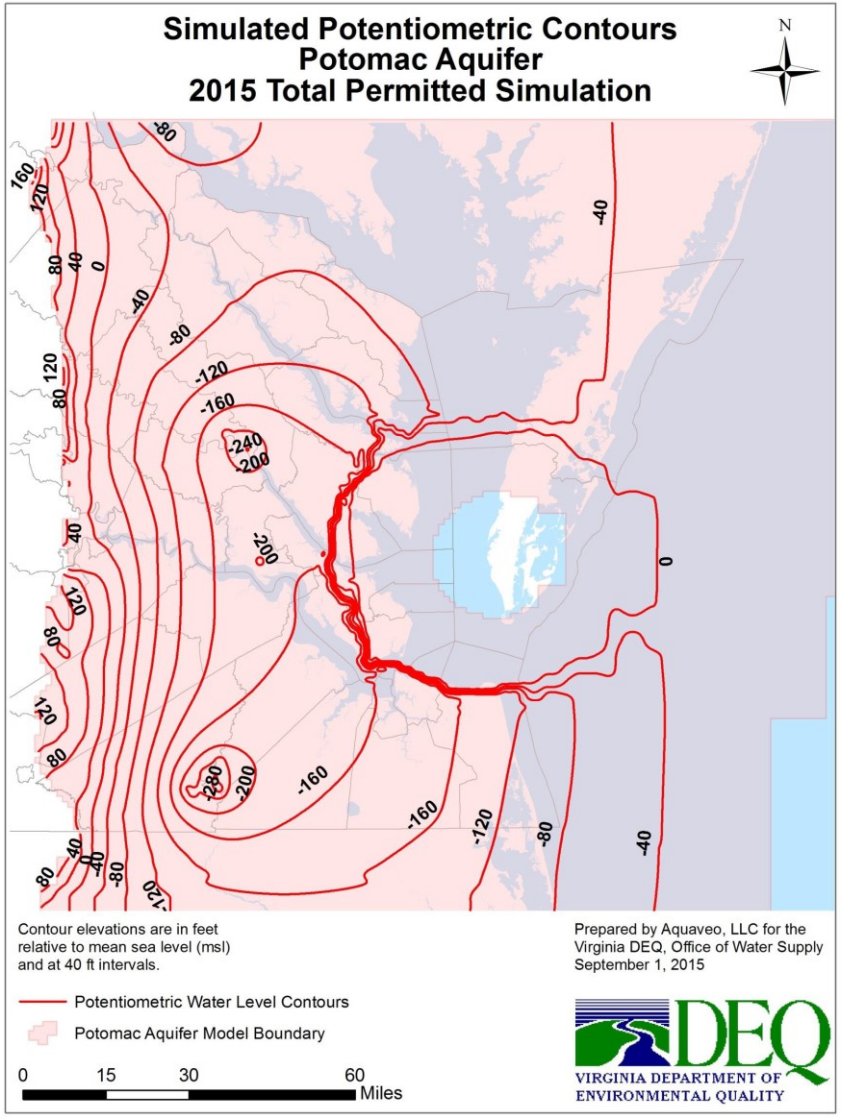
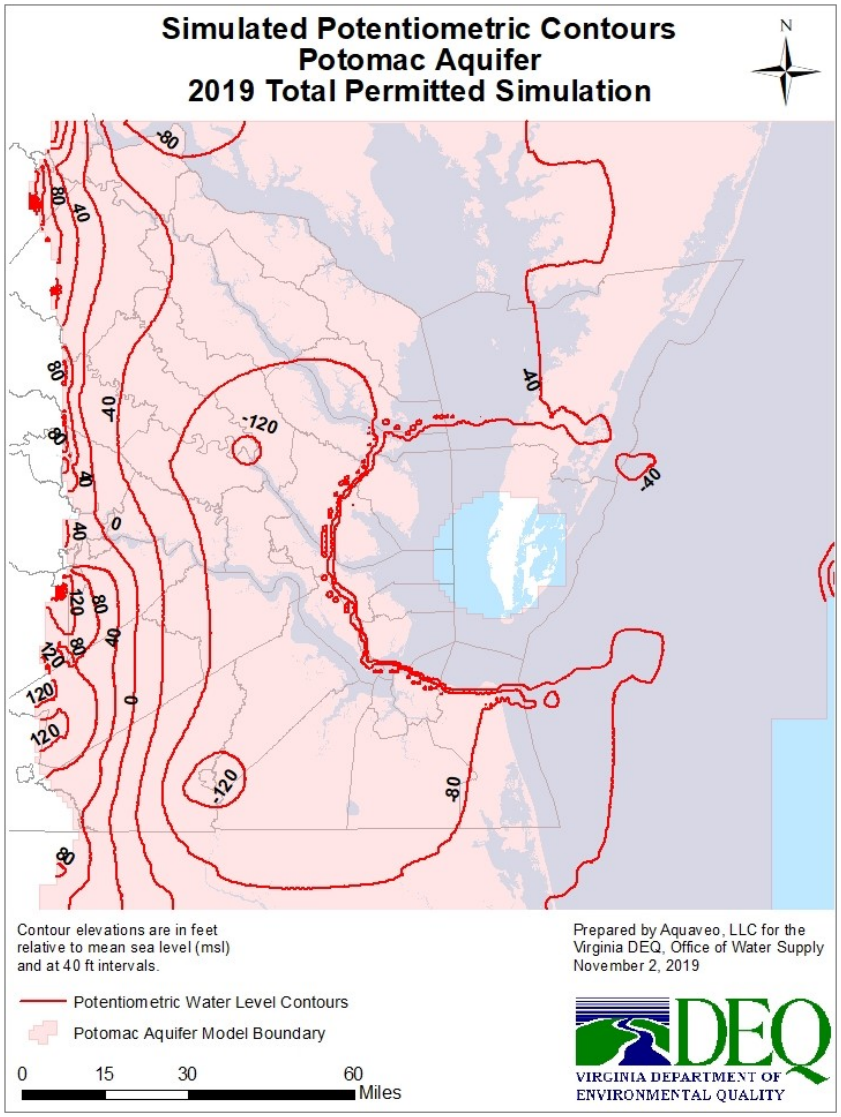
DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

VCPM – Total Permitted





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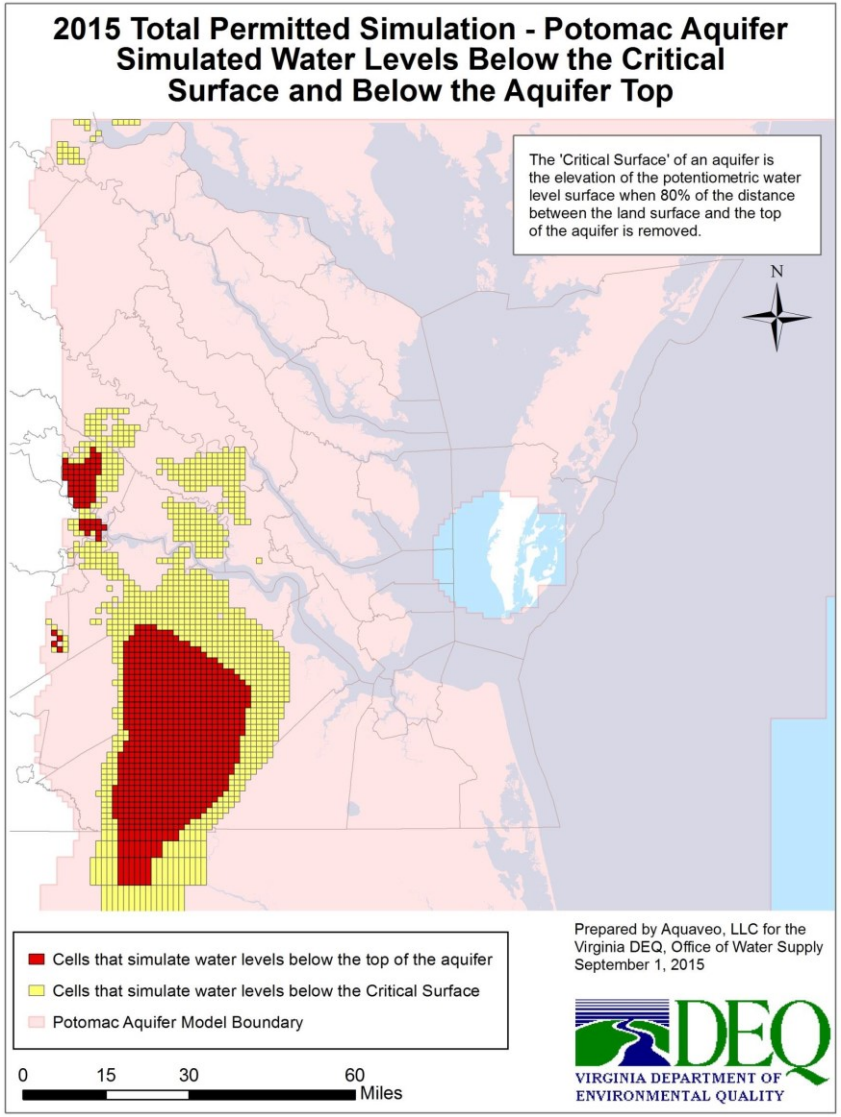
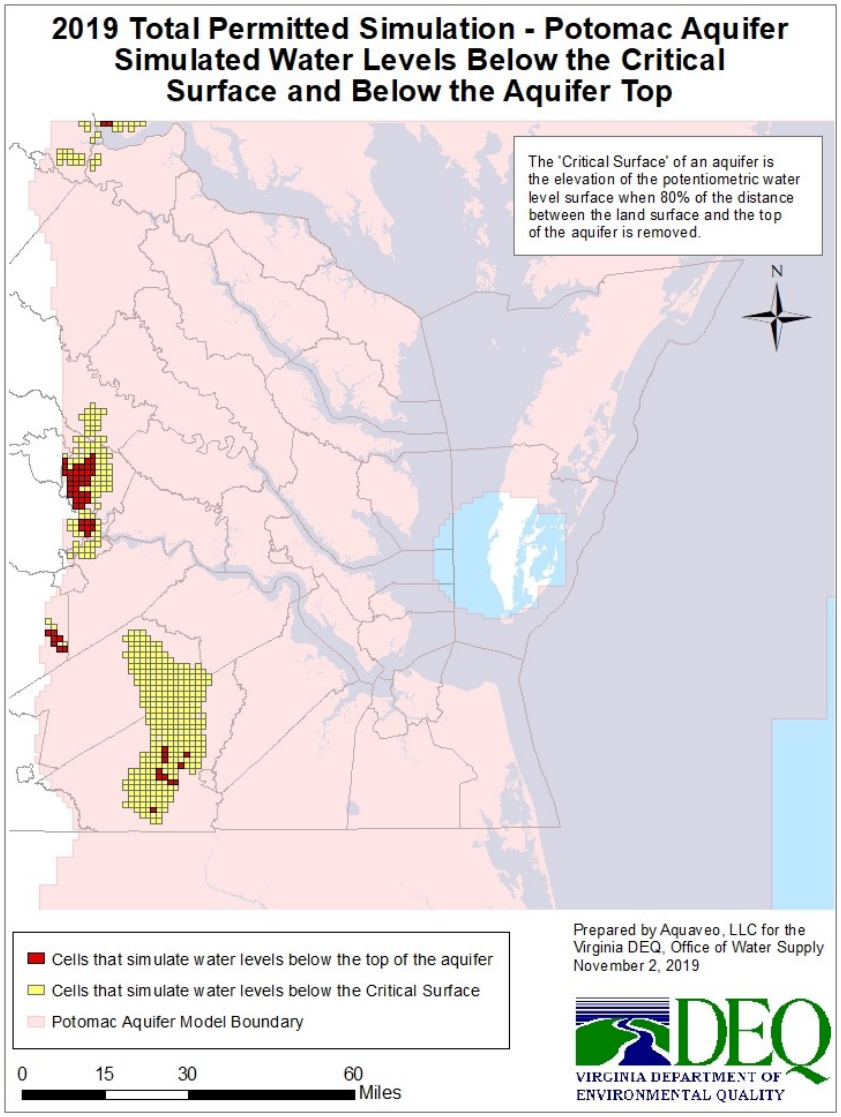
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

VCPM – Total Permitted





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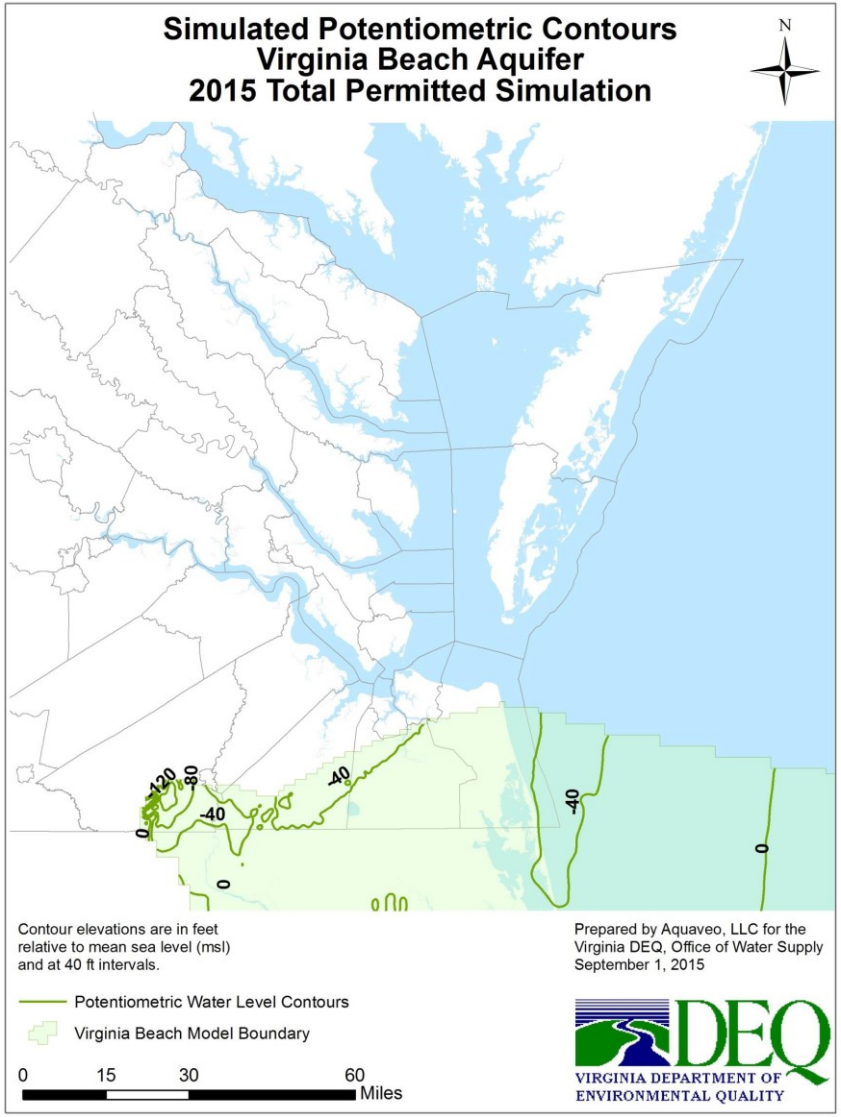
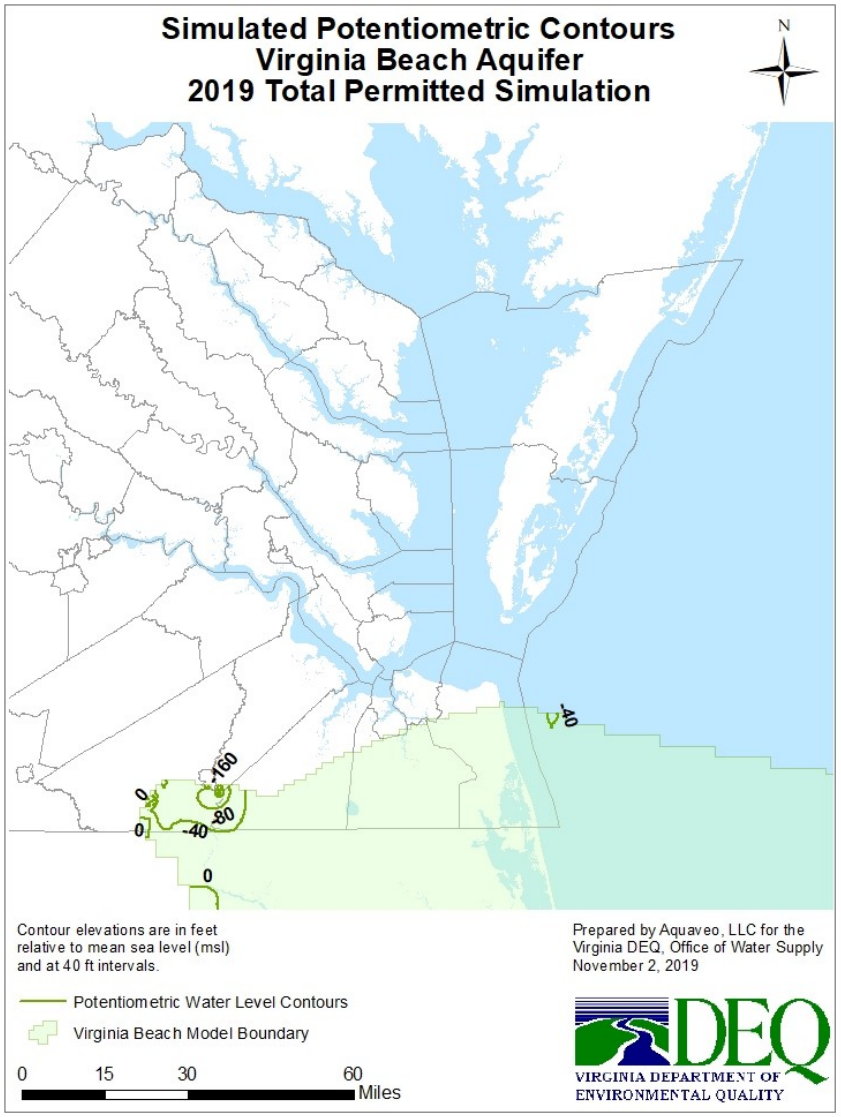
DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

VCPM – Total Permitted





Water Modeling Solutions

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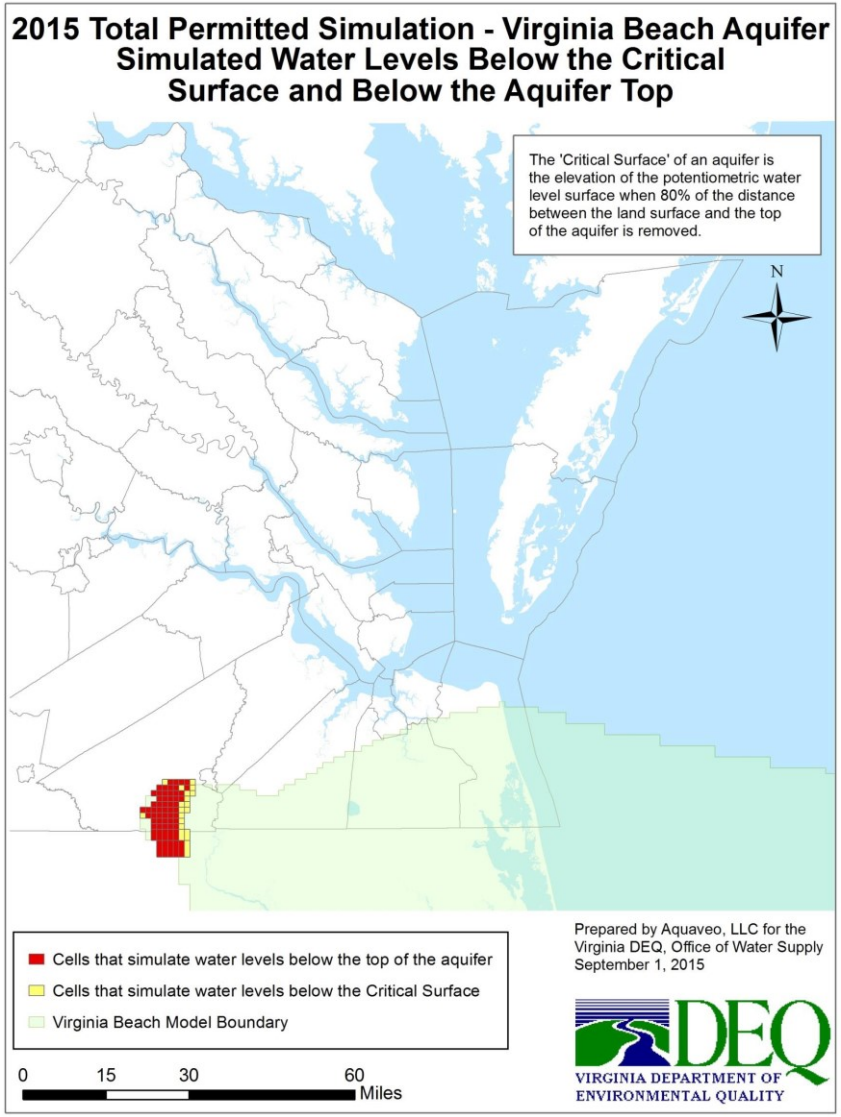
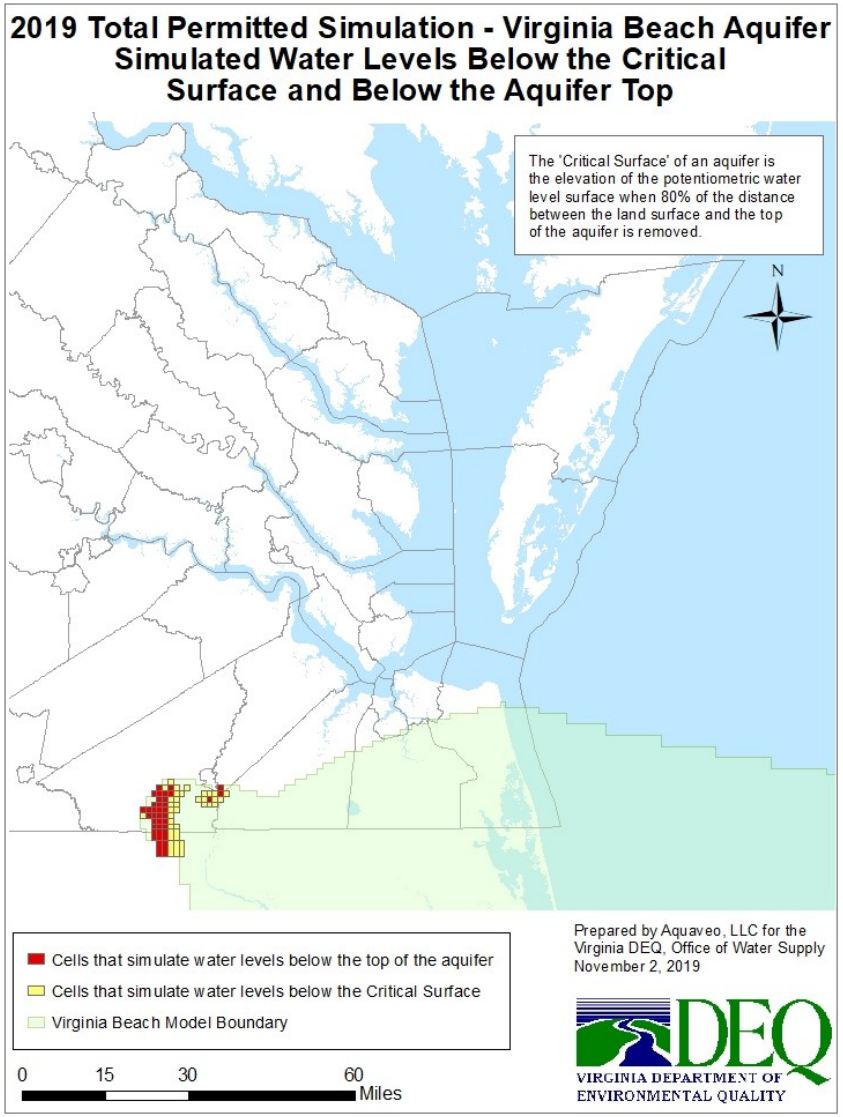
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

VCPM – Total Permitted





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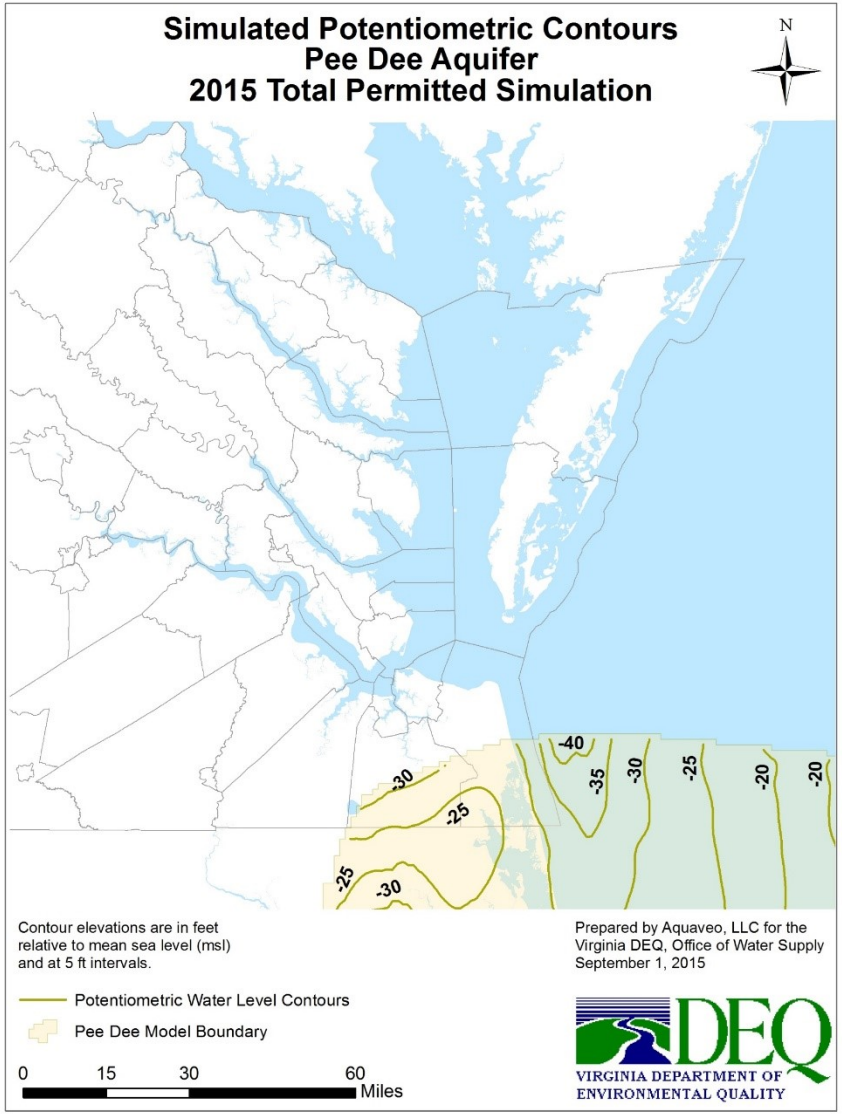
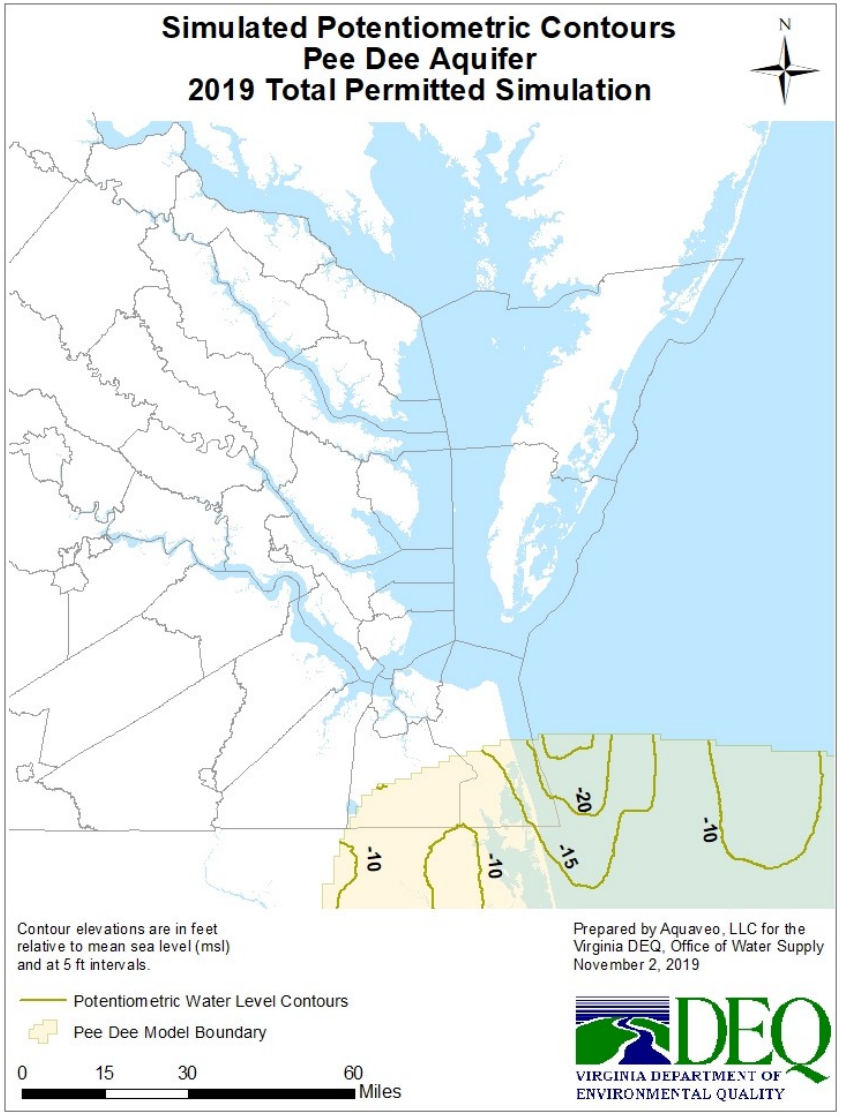
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

VCPM – Total Permitted





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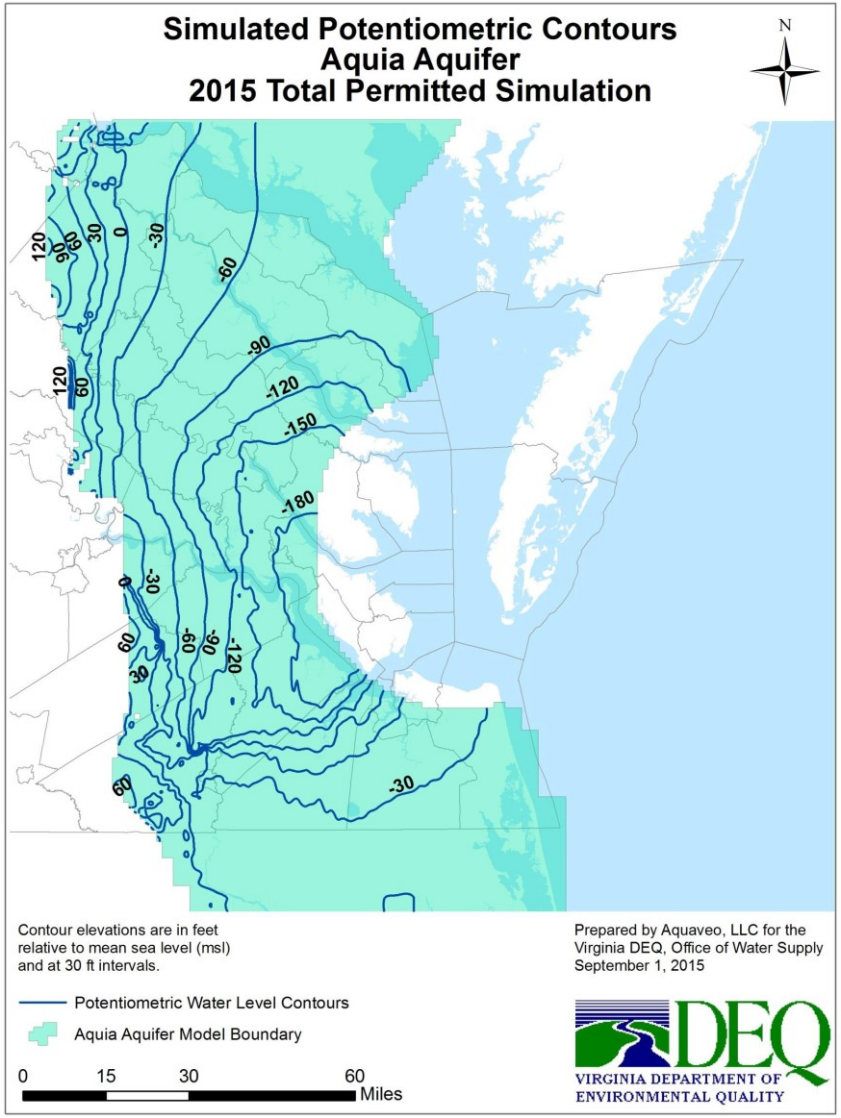
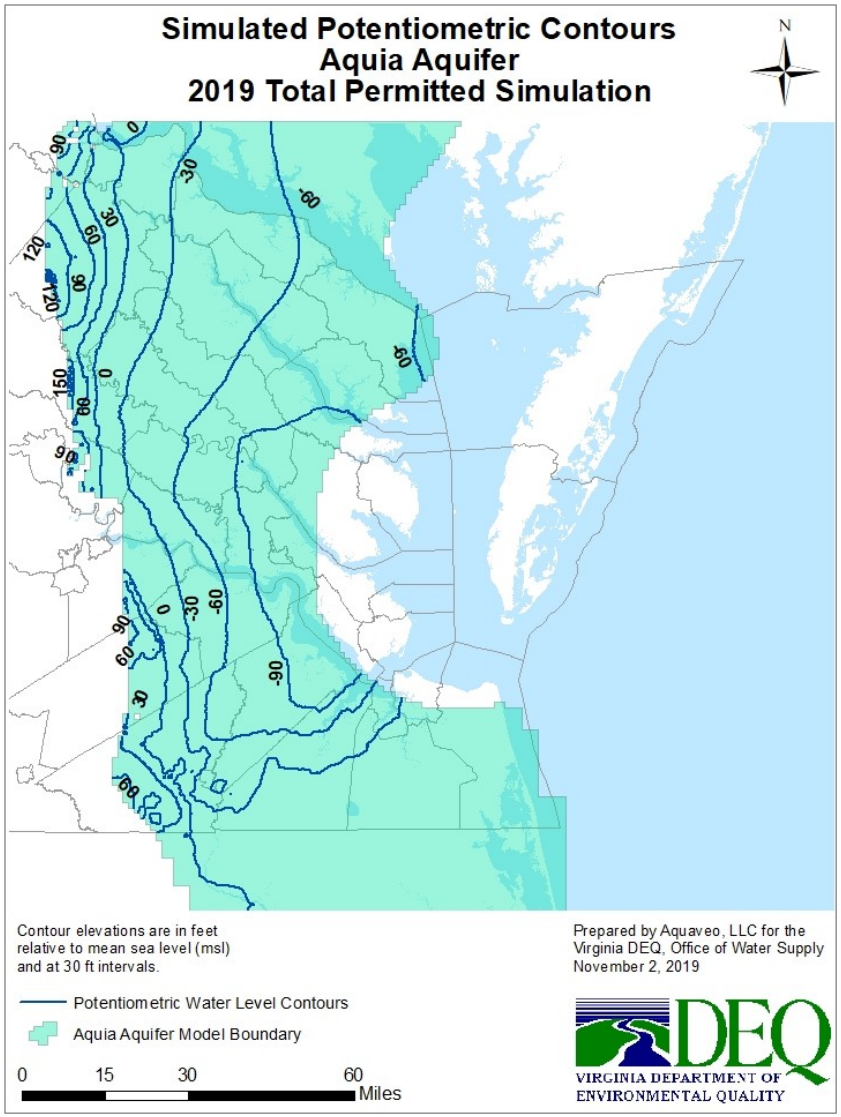
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

VCPM – Total Permitted





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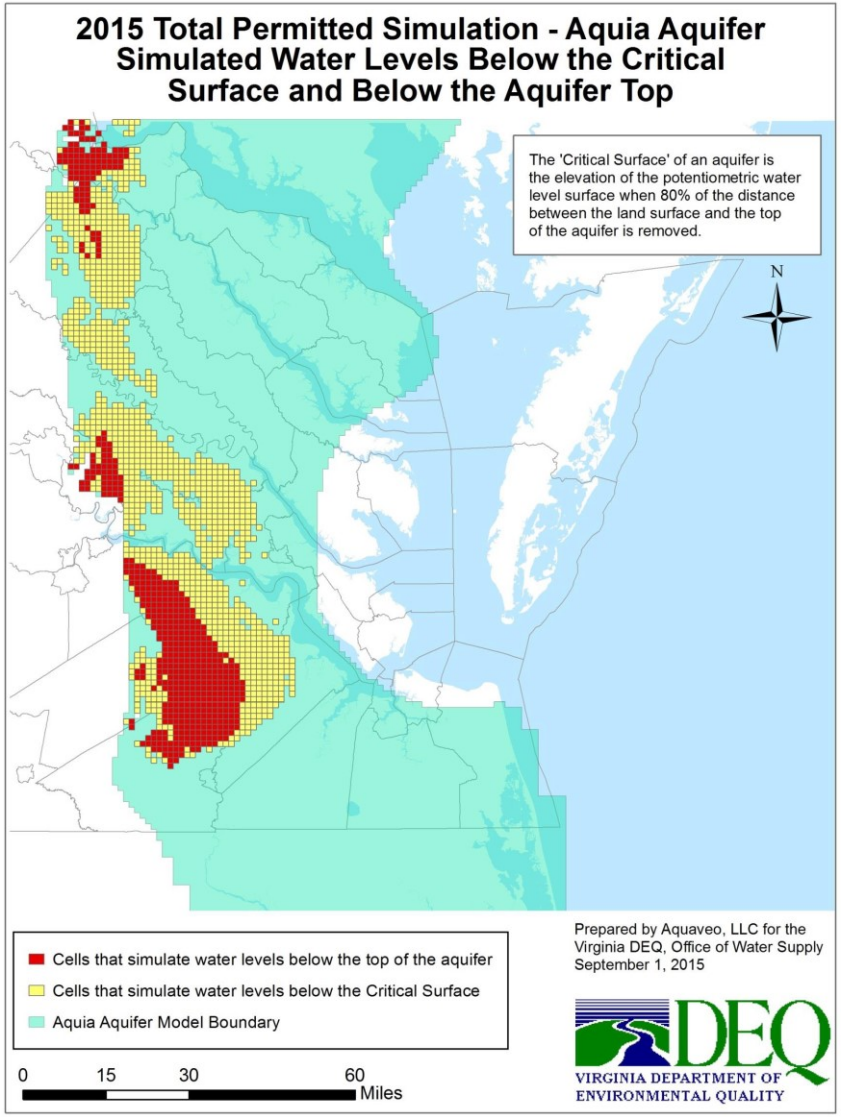
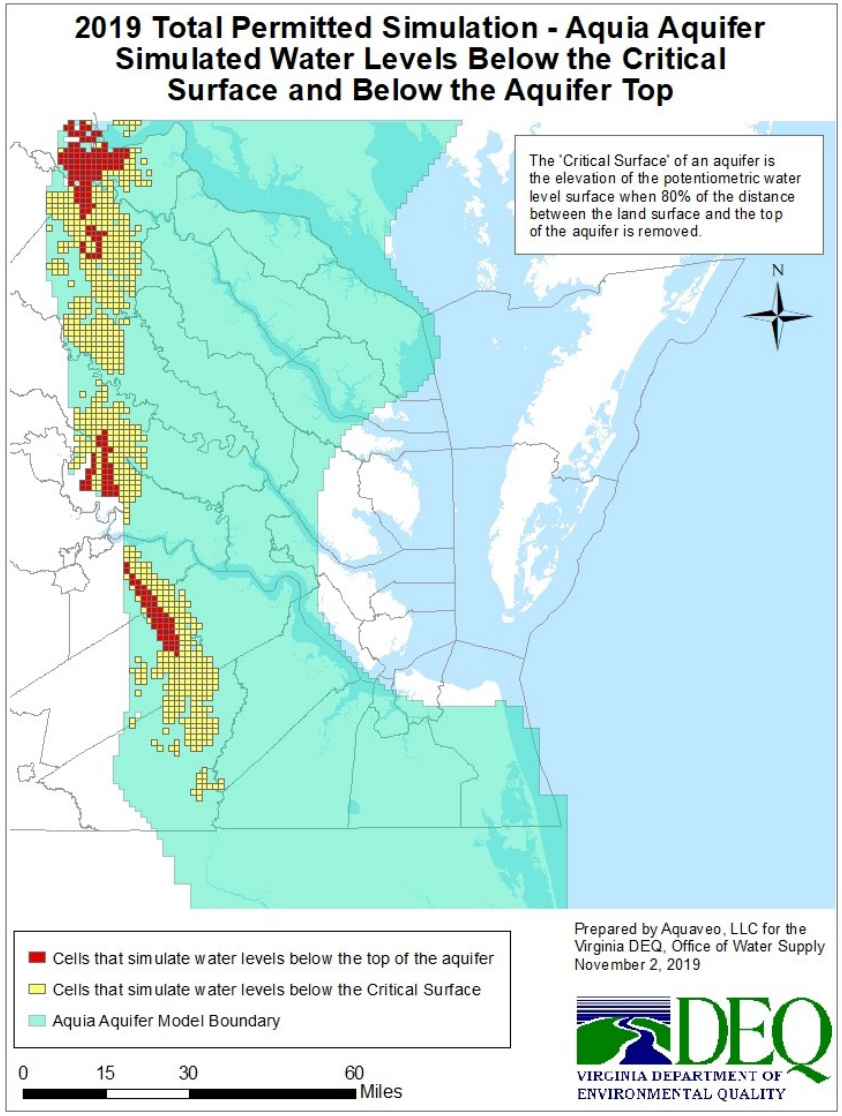
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

VCPM – Total Permitted





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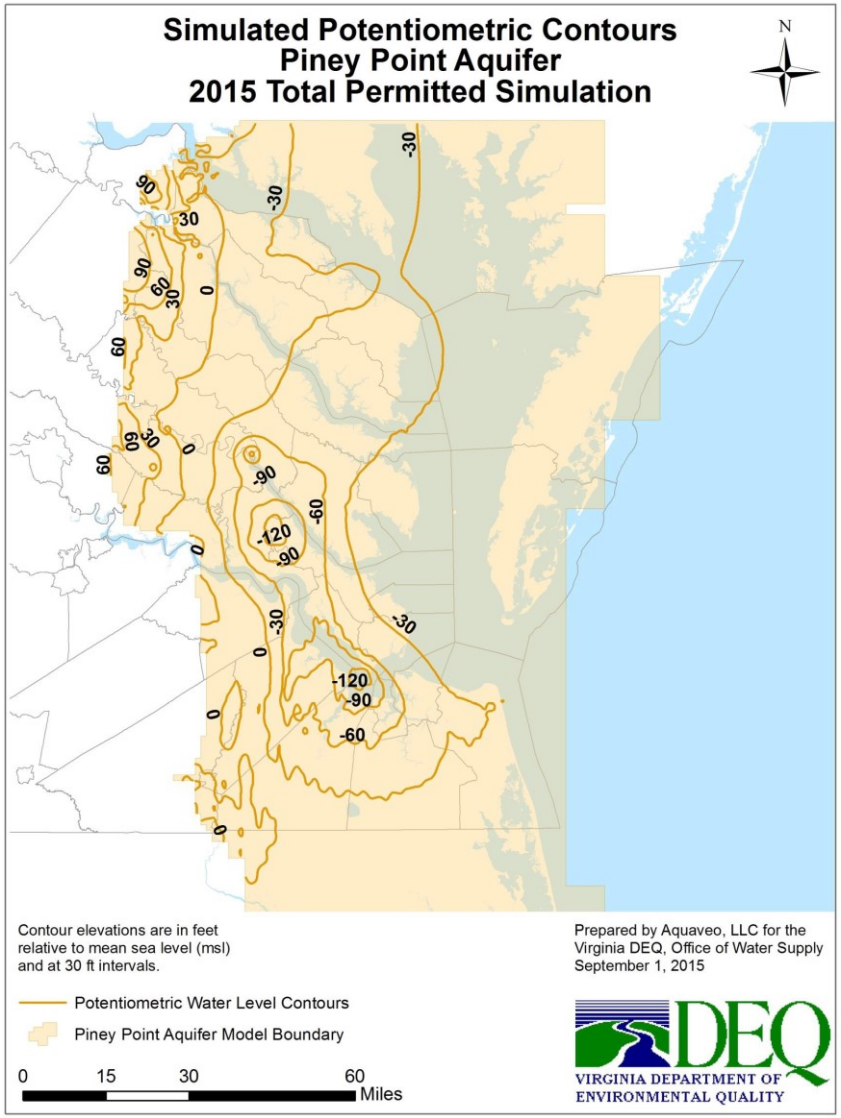
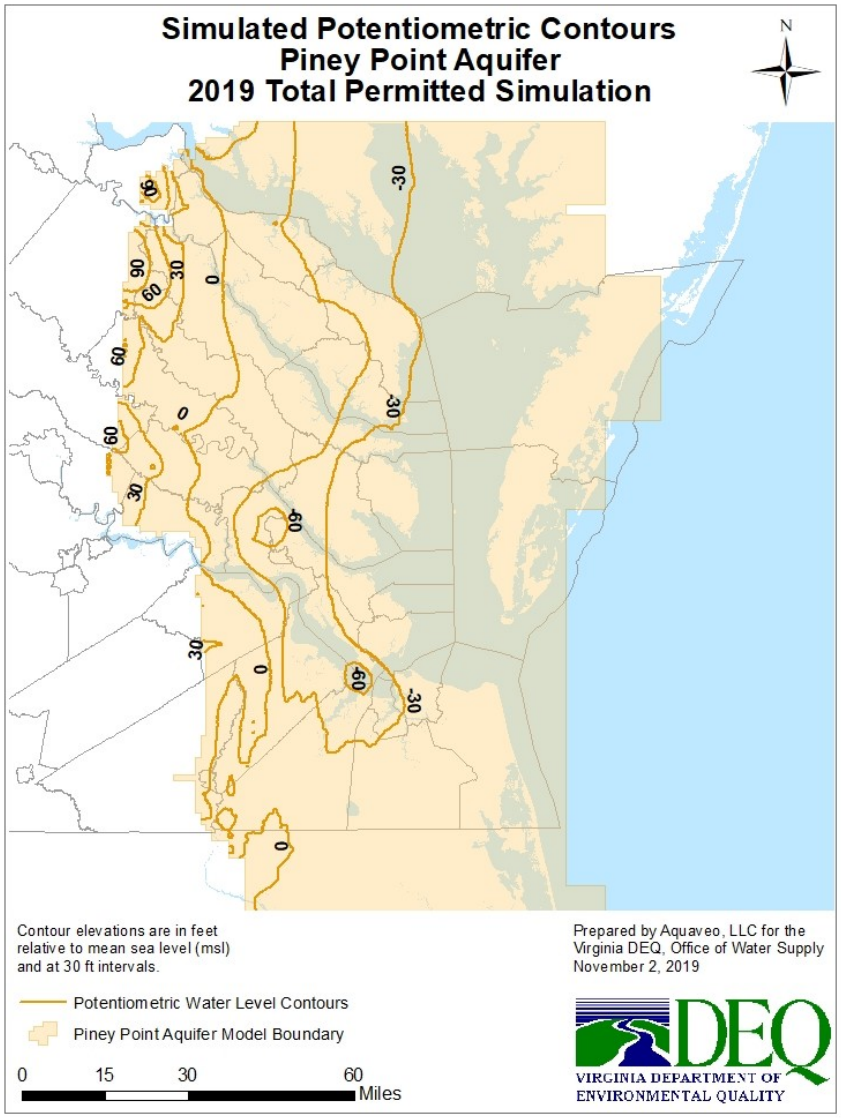
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

VCPM – Total Permitted





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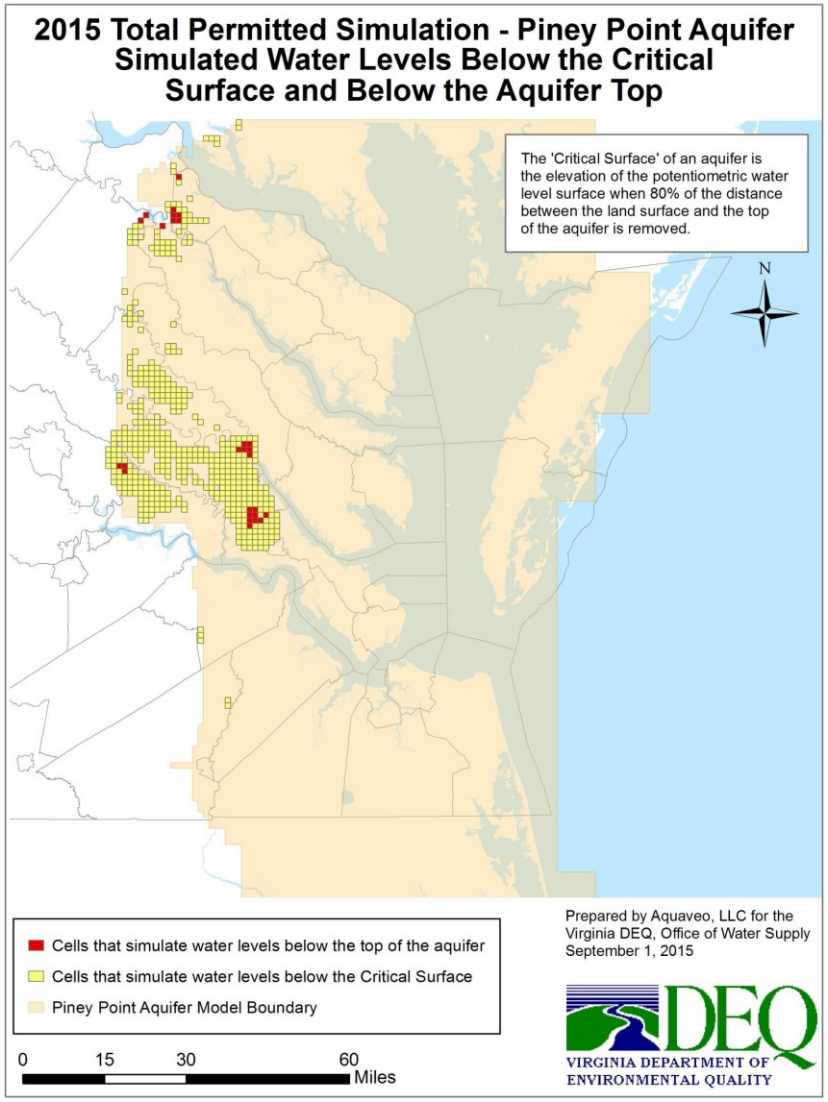
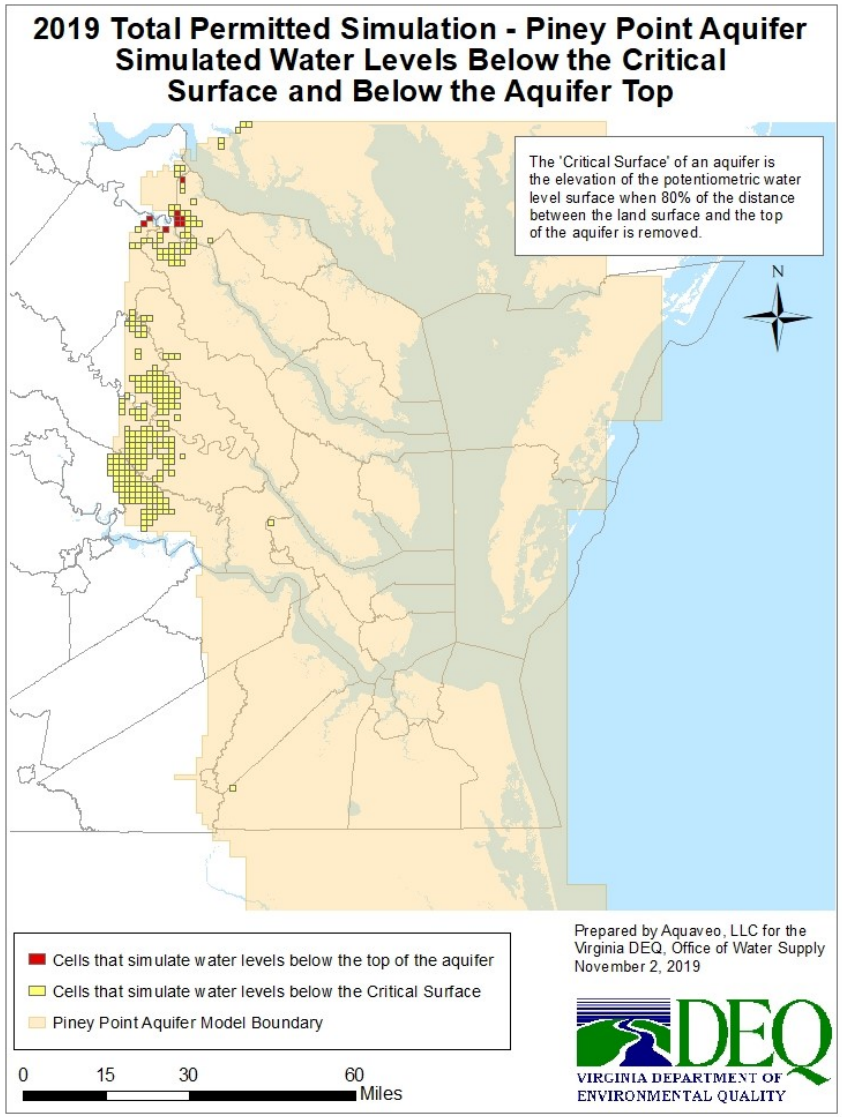
DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

VCPM – Total Permitted





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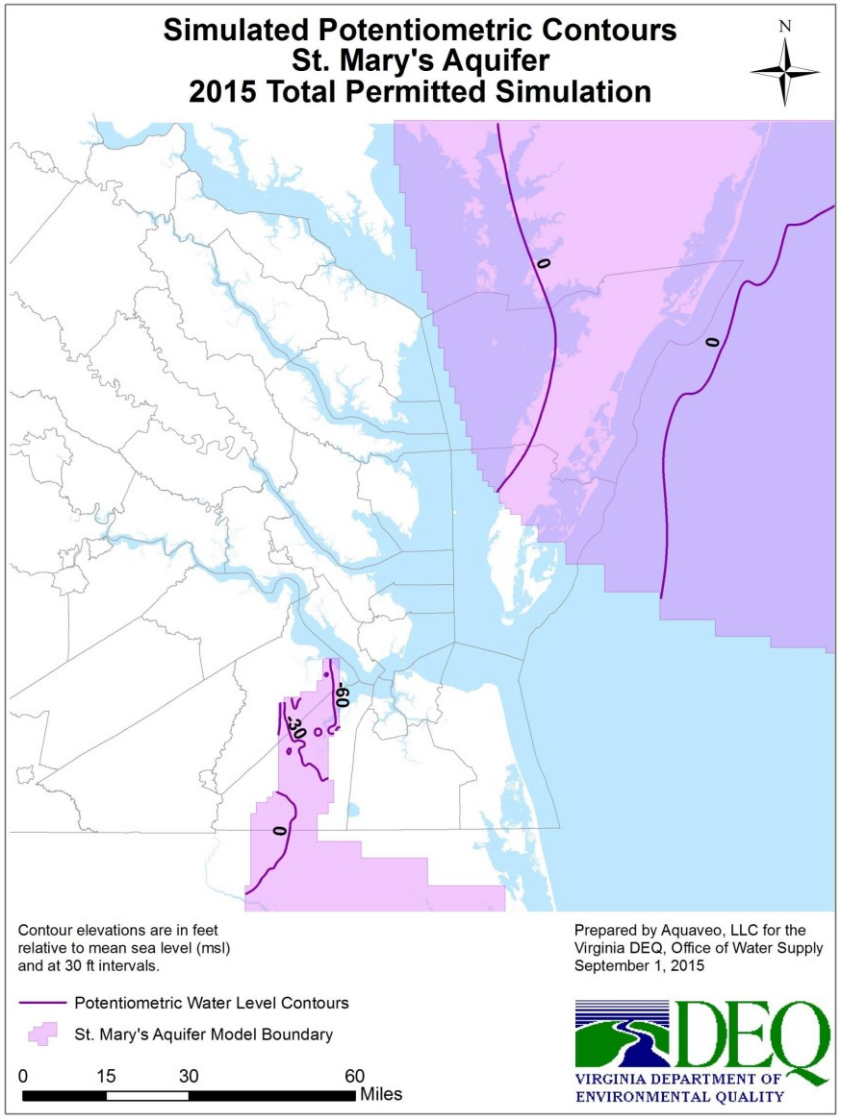
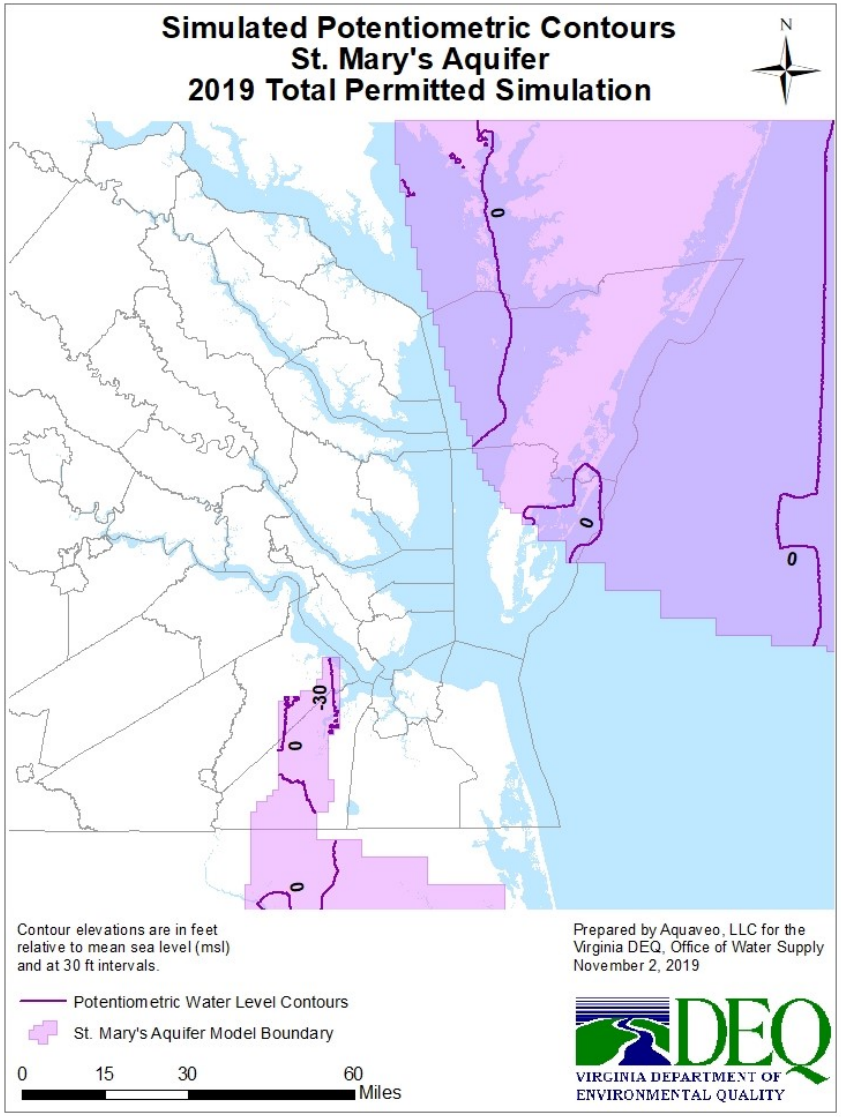
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

VCPM – Total Permitted





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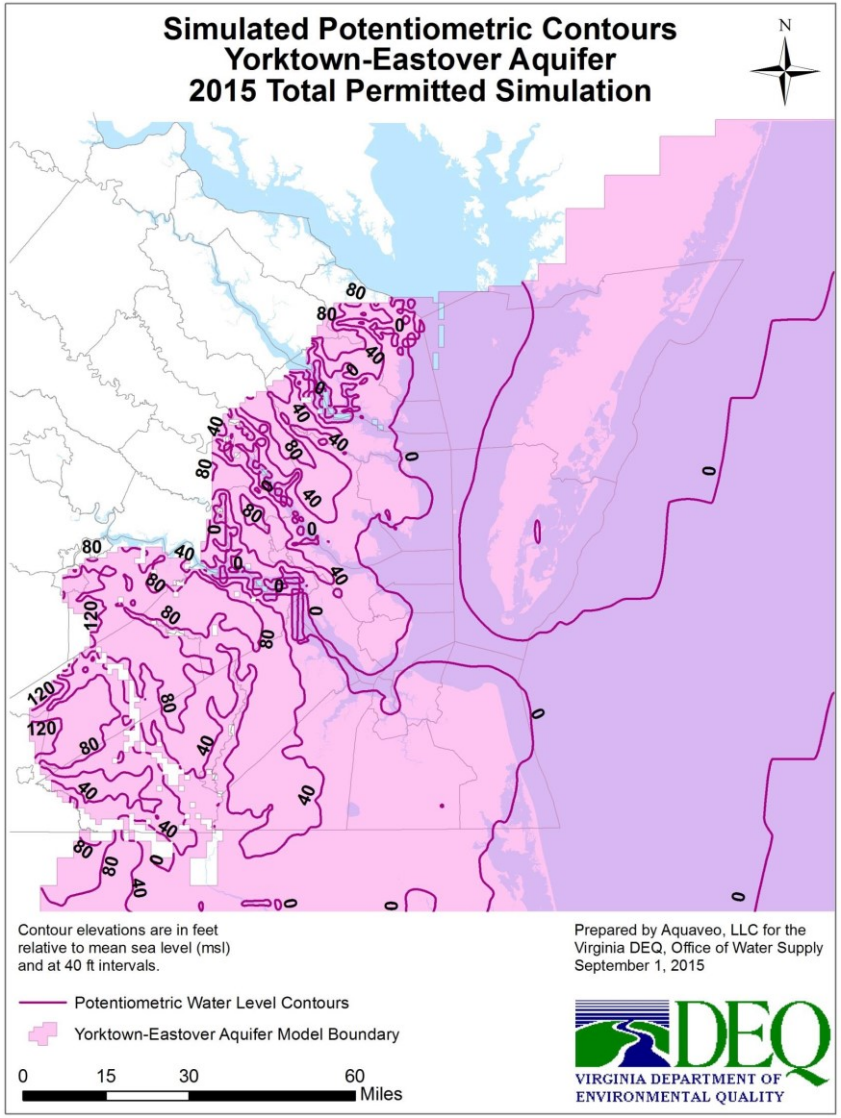
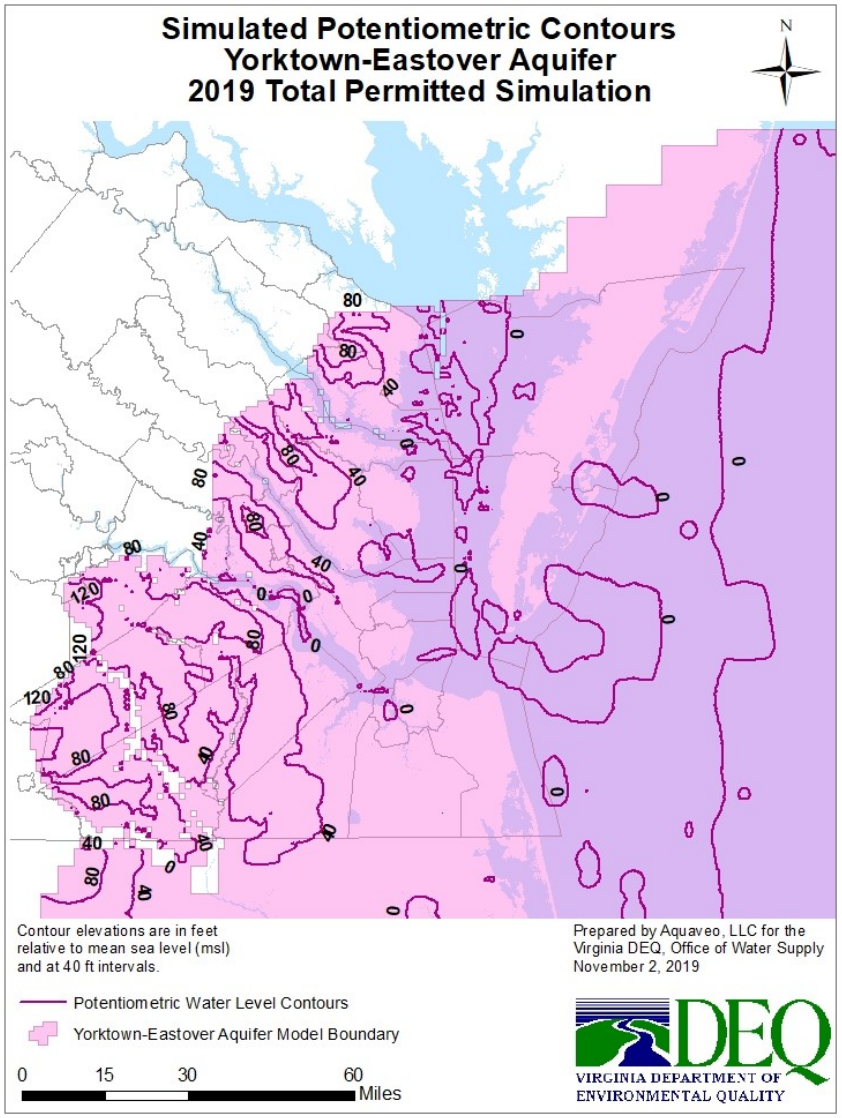
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

VCPM – Total Permitted





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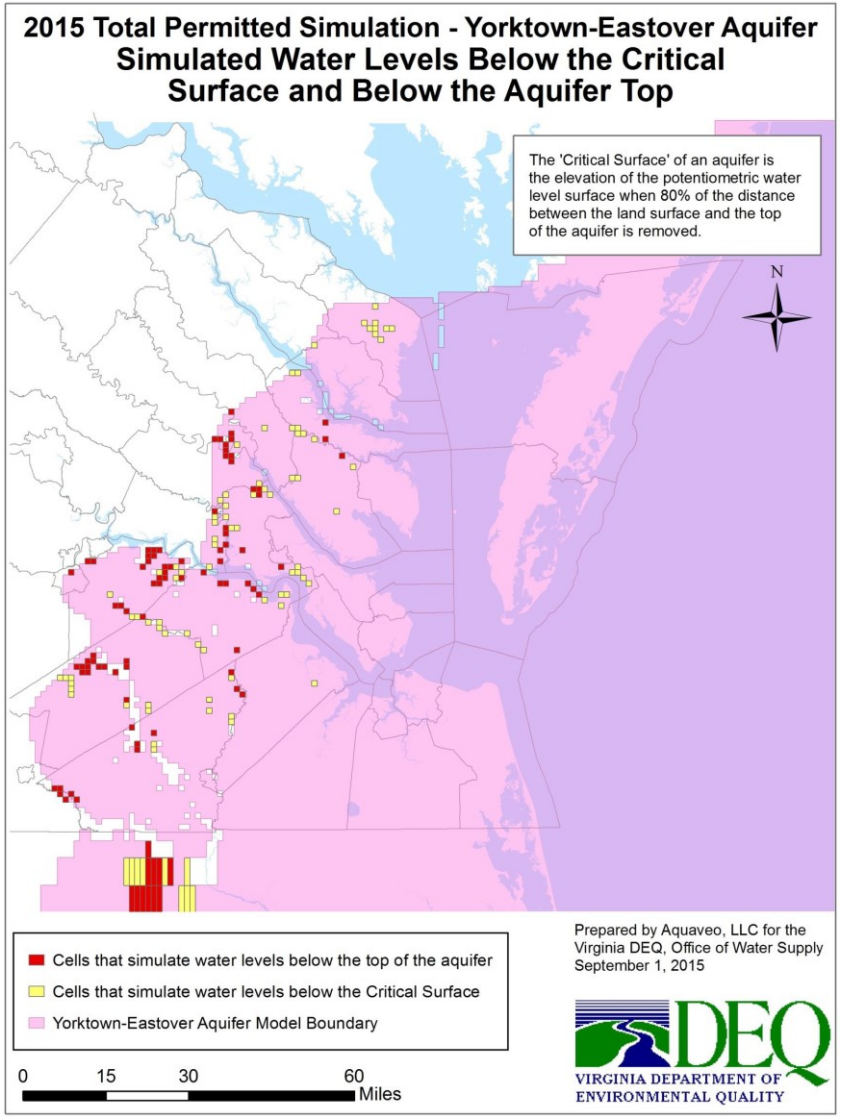
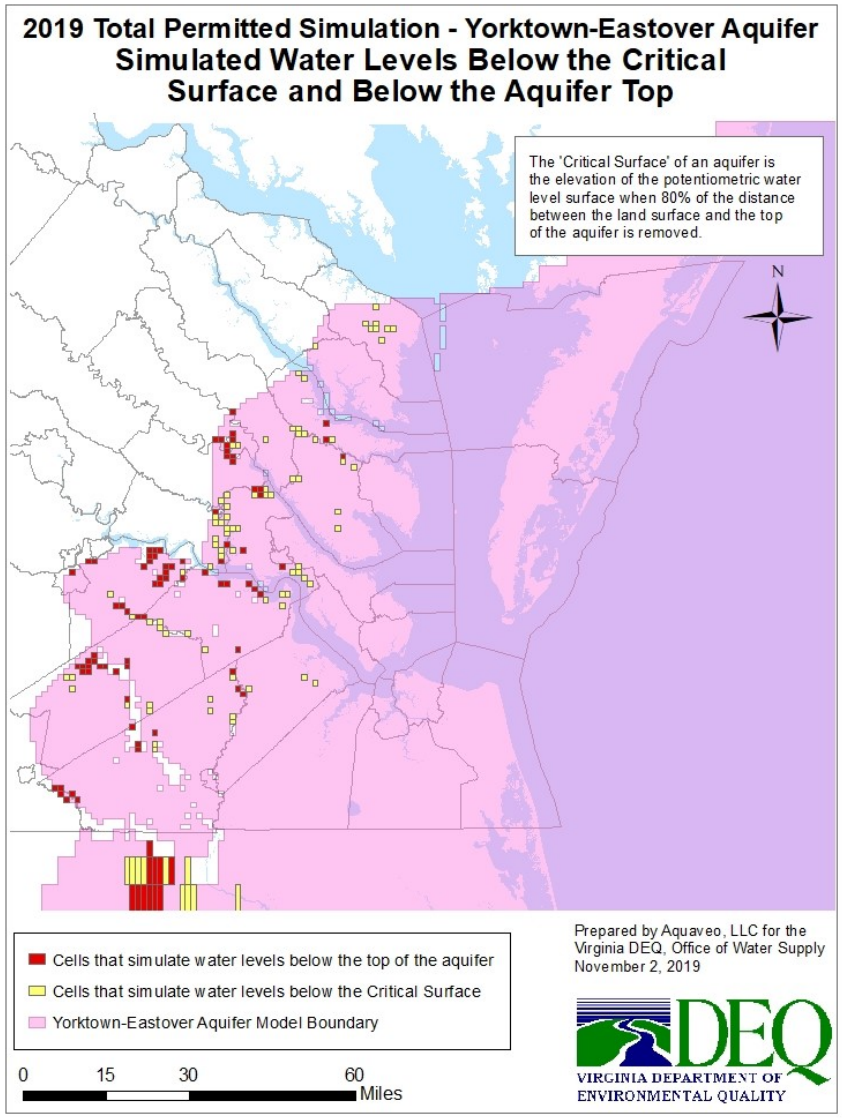
DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

VCPM – Total Permitted





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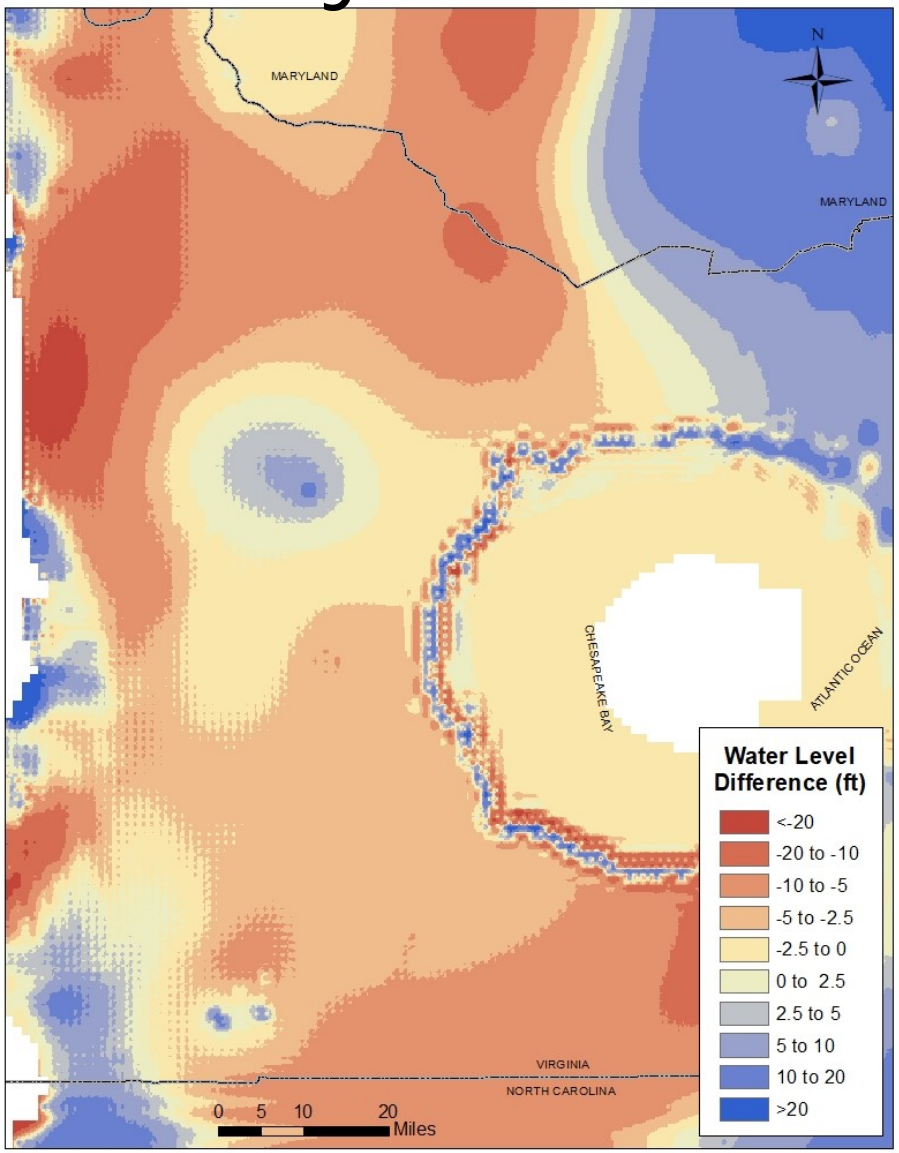
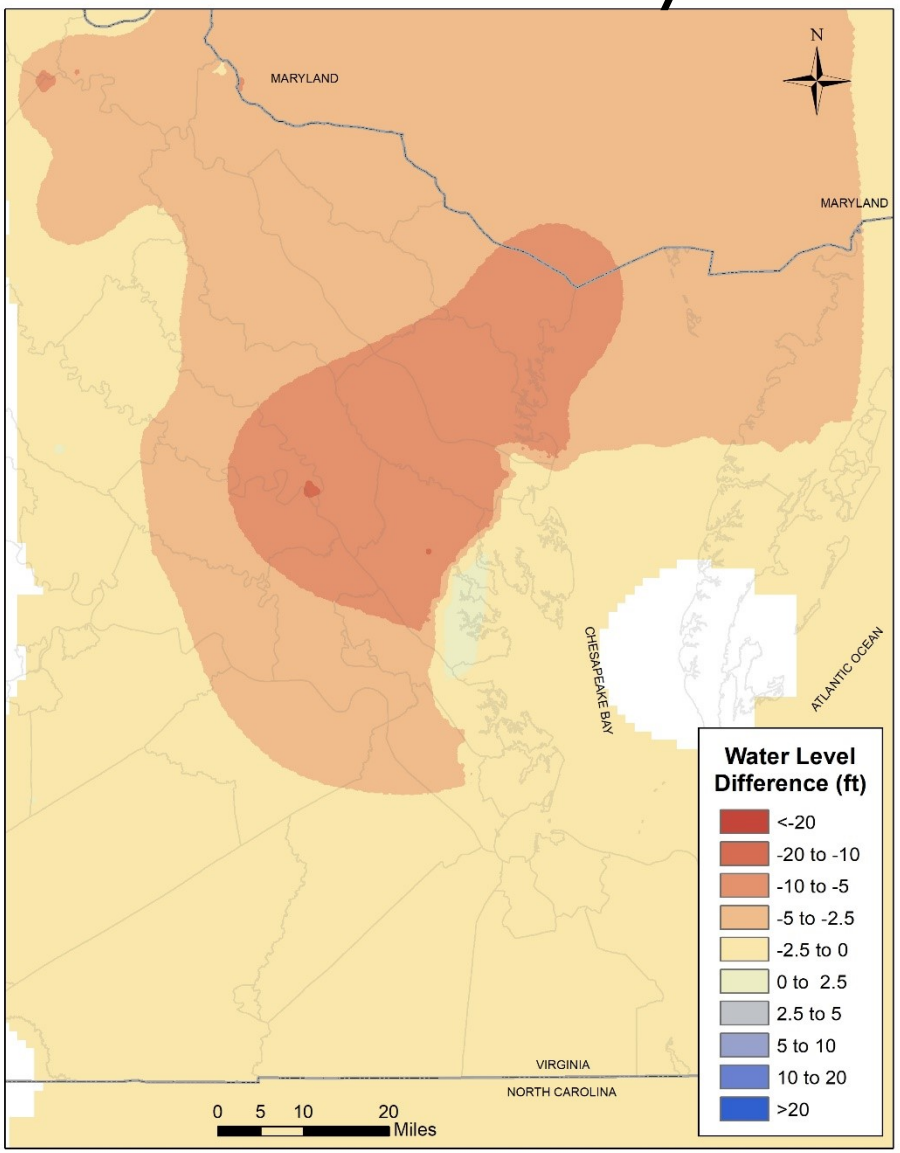
DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

TP Simulations – Potomac

2019 minus 2018



2018 minus 2017

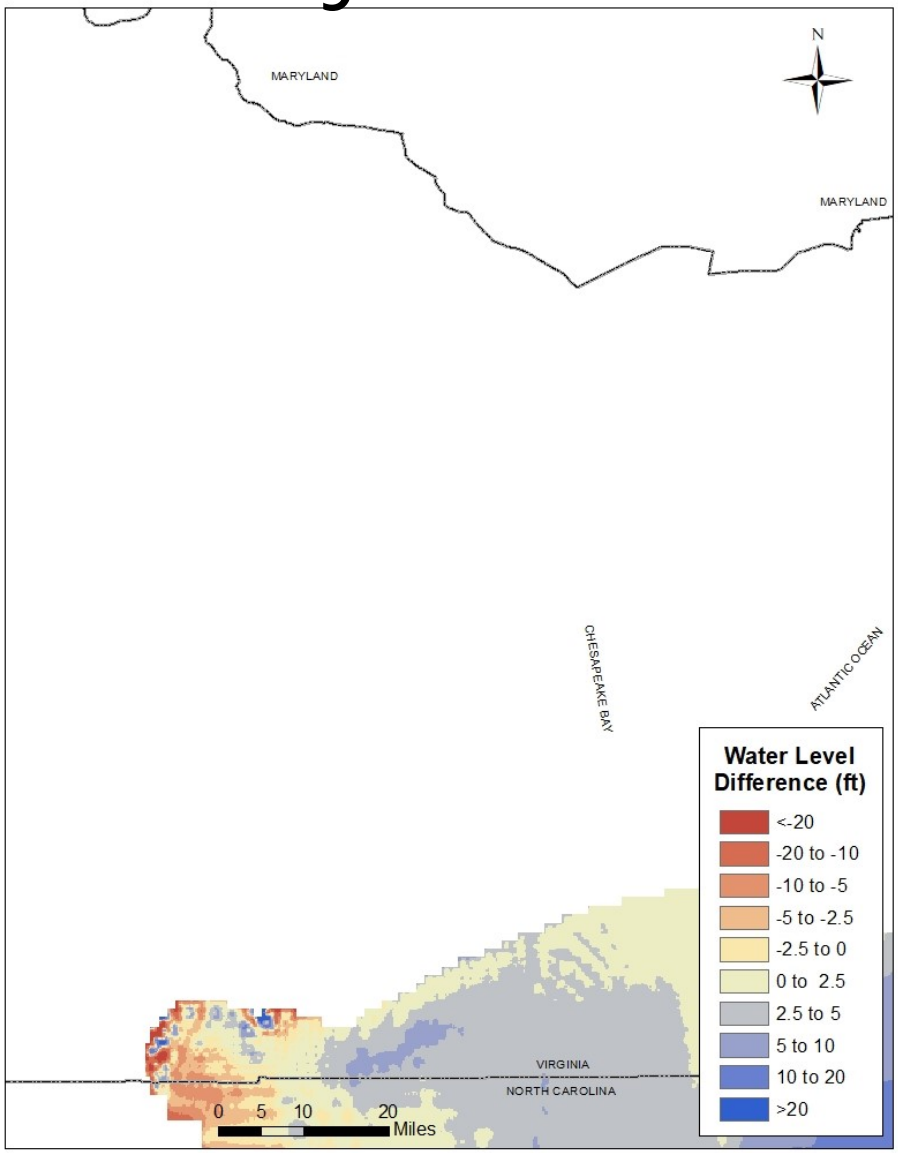


Water Modeling Solutions

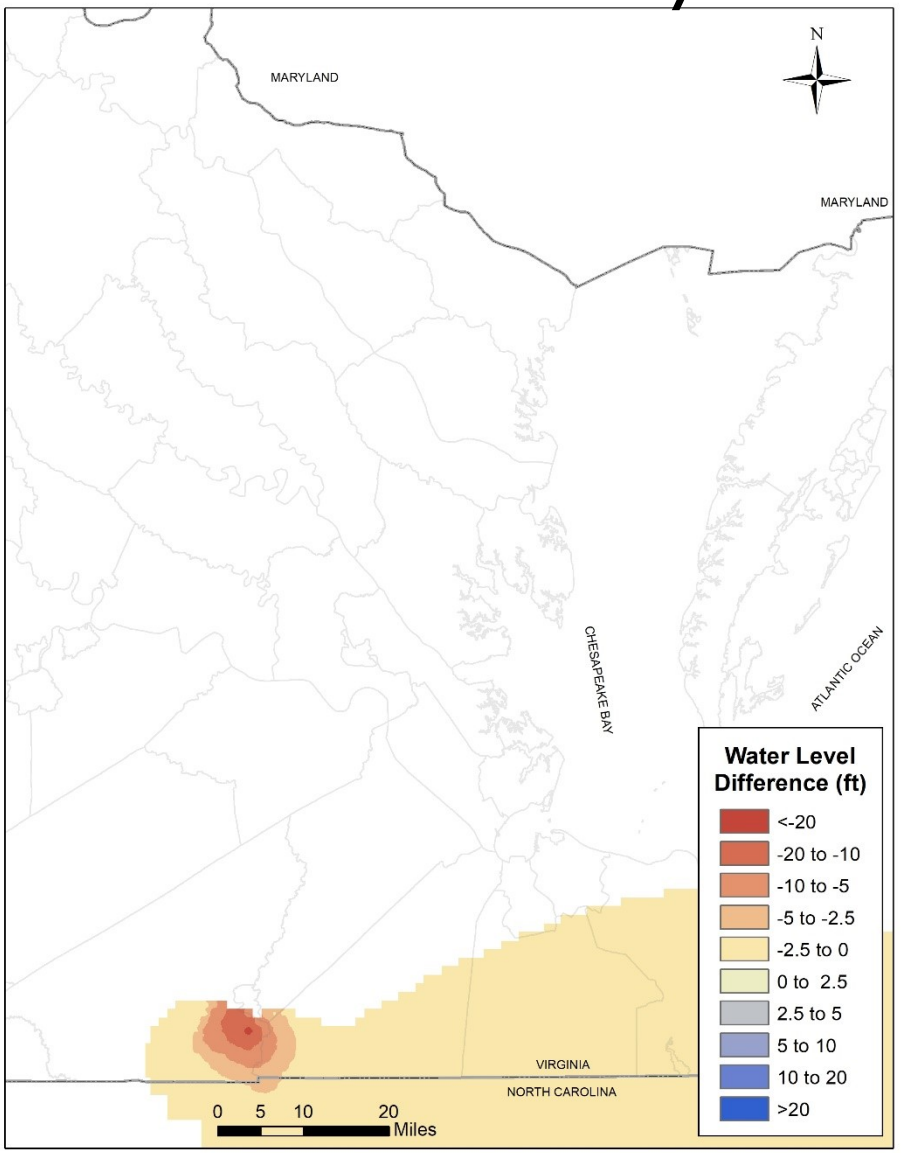
DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

TP Simulations–Virginia Beach

2019 minus 2018



2018 minus 2017

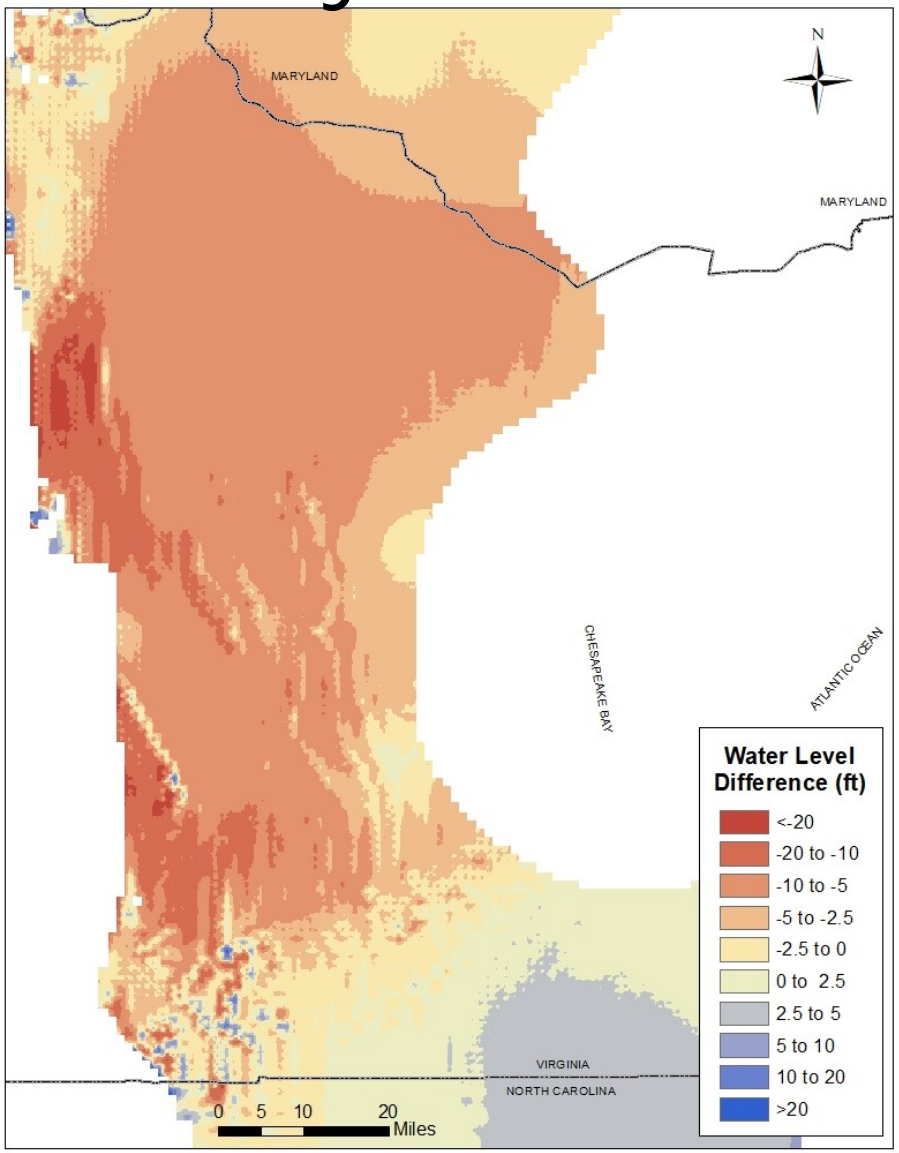


Water Modeling Solutions

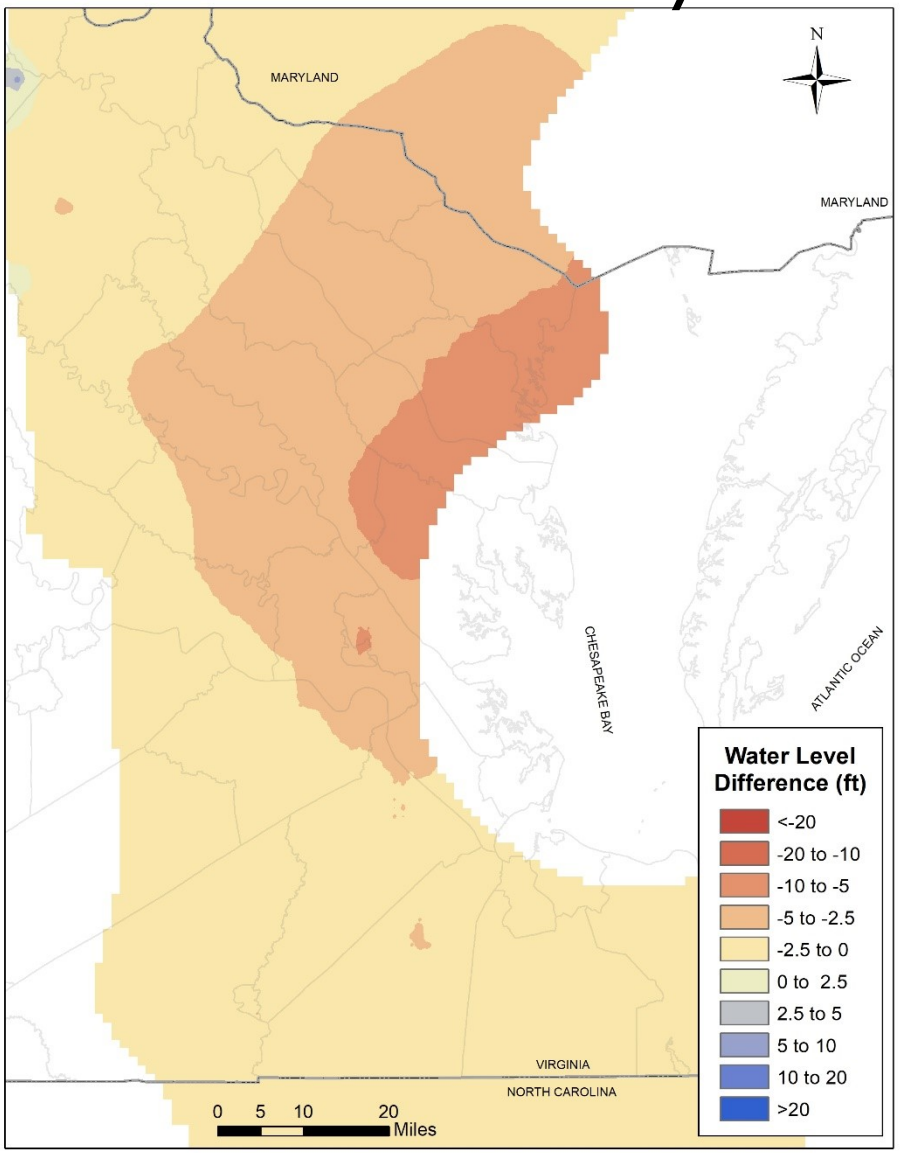
DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

TP Simulations – Aquia

2019 minus 2018



2018 minus 2017

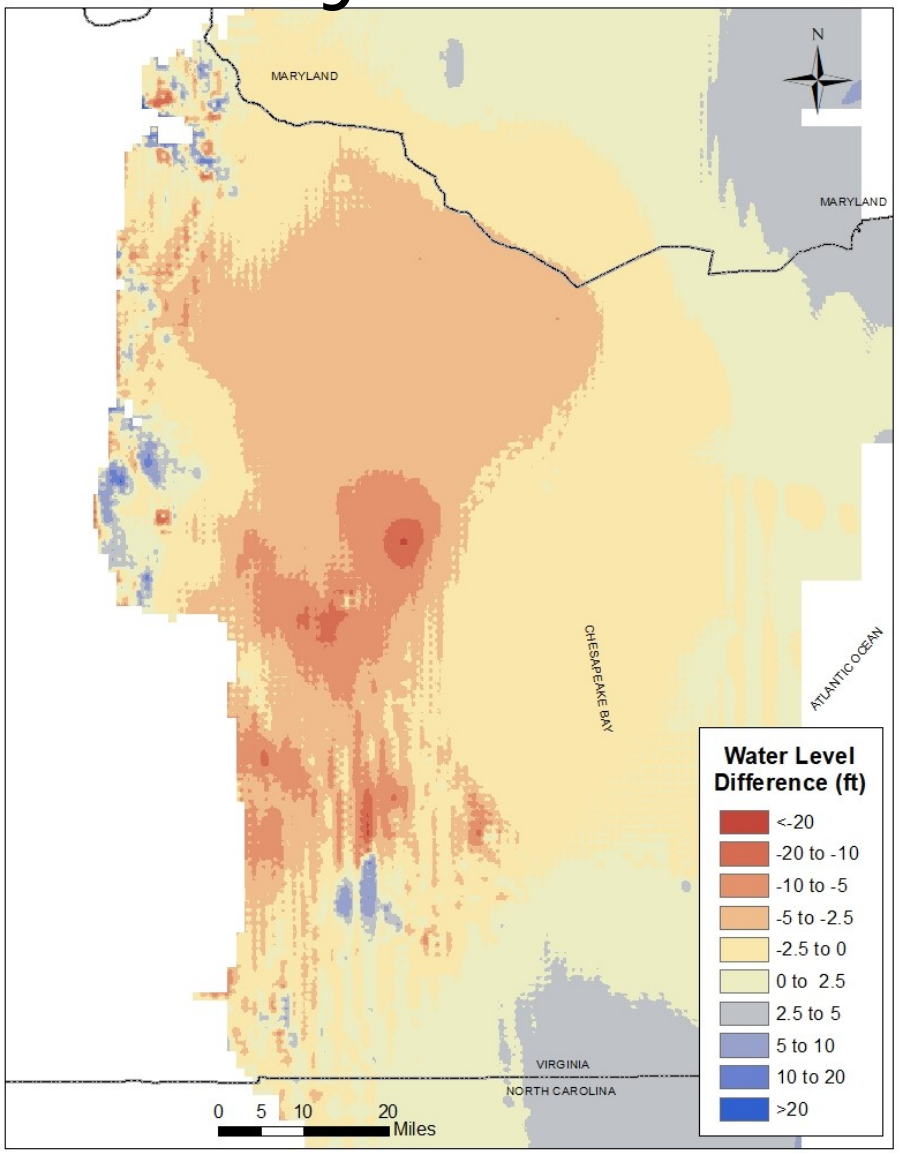


Water Modeling Solutions

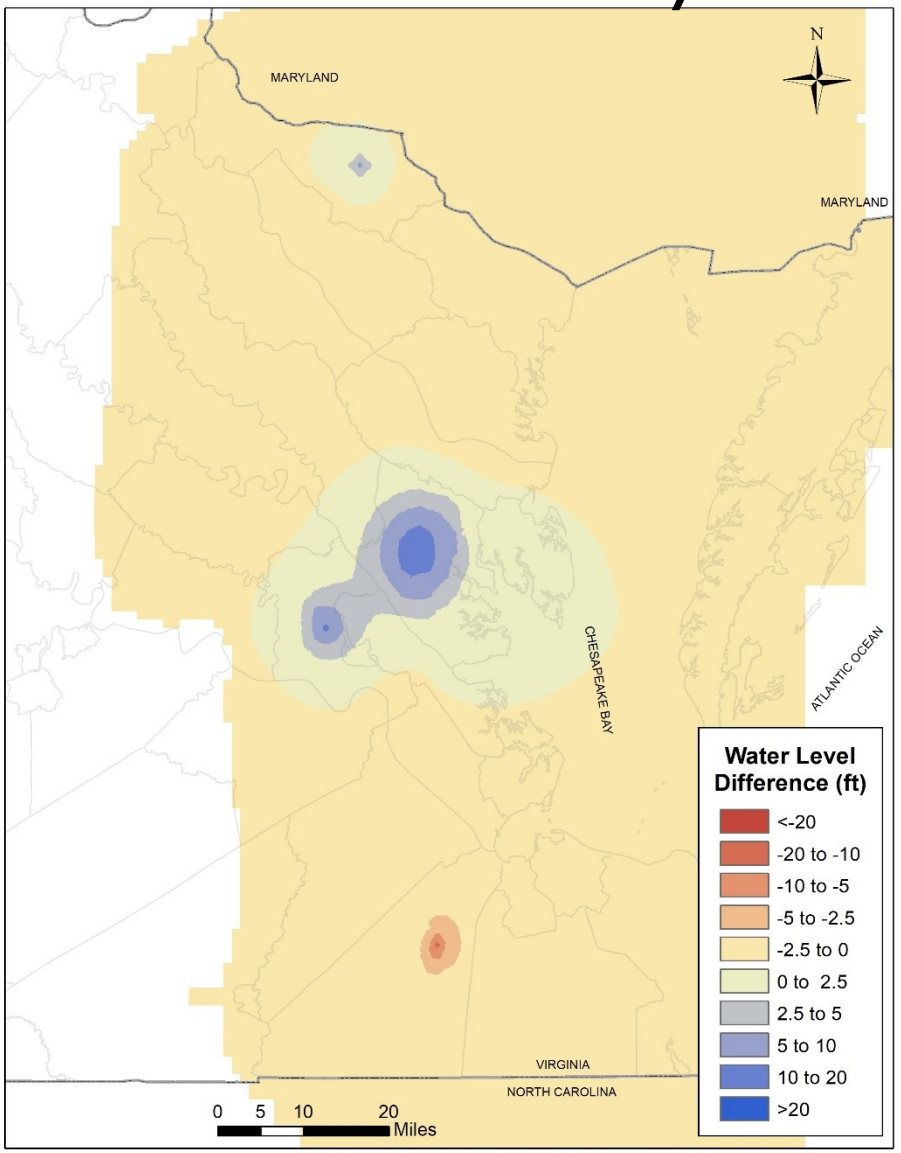
DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

TP Simulations – Piney Point

2019 minus 2018



2018 minus 2017

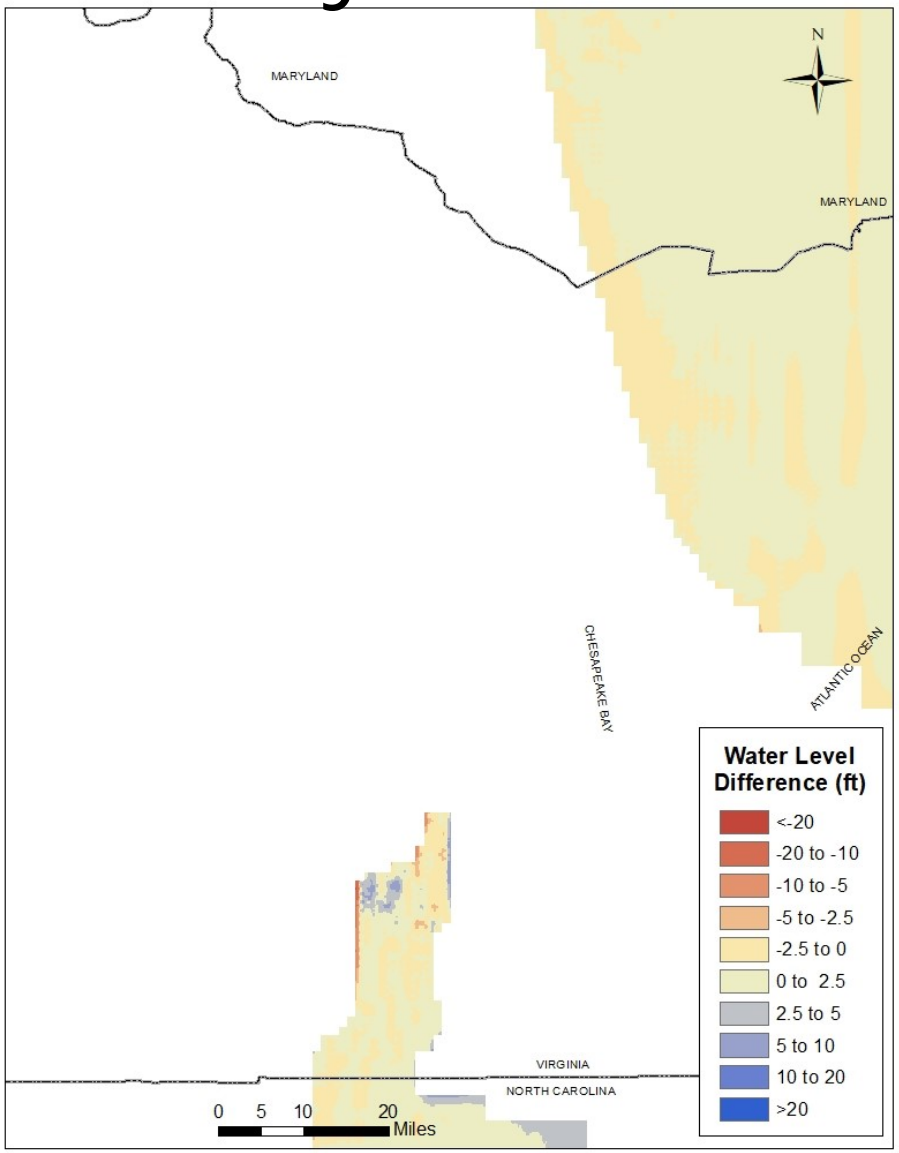


Water Modeling Solutions

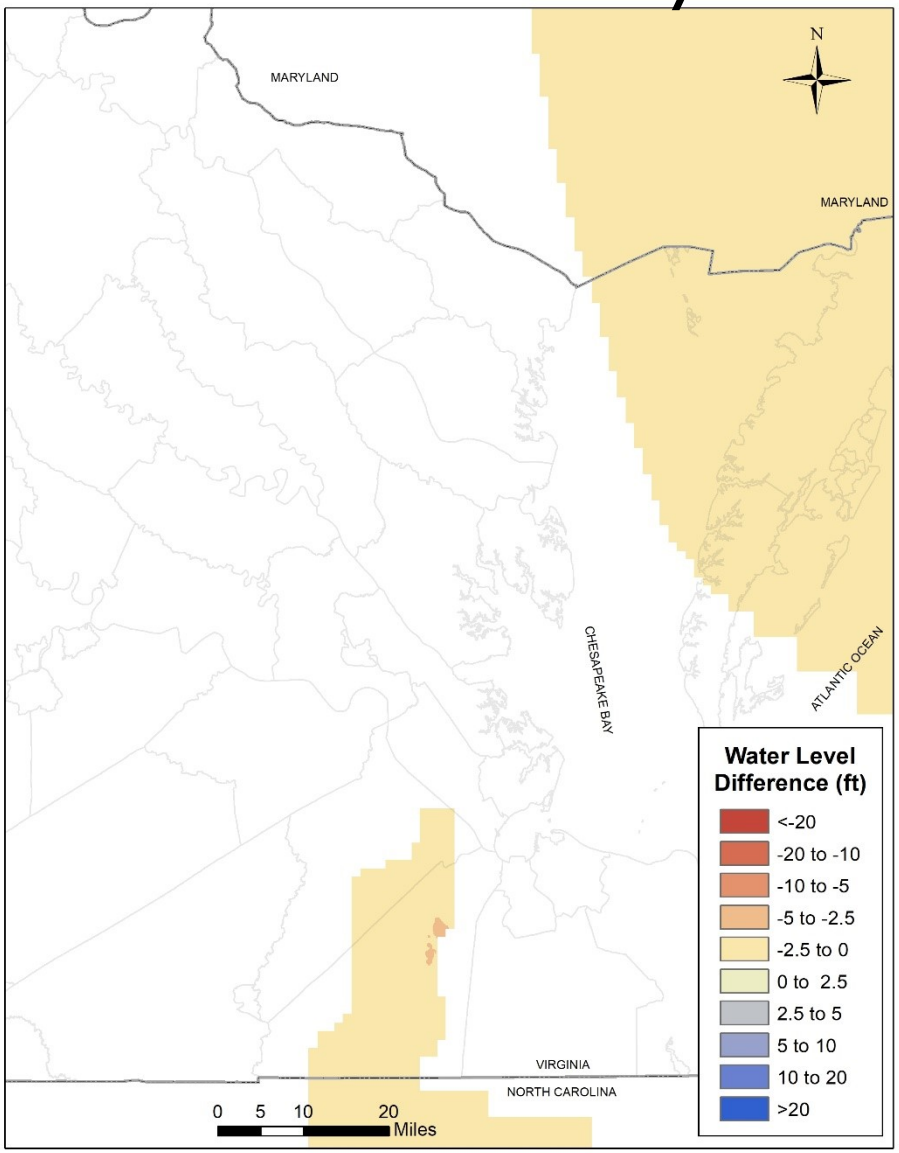
DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

TP Simulations – St. Marys

2019 minus 2018



2018 minus 2017

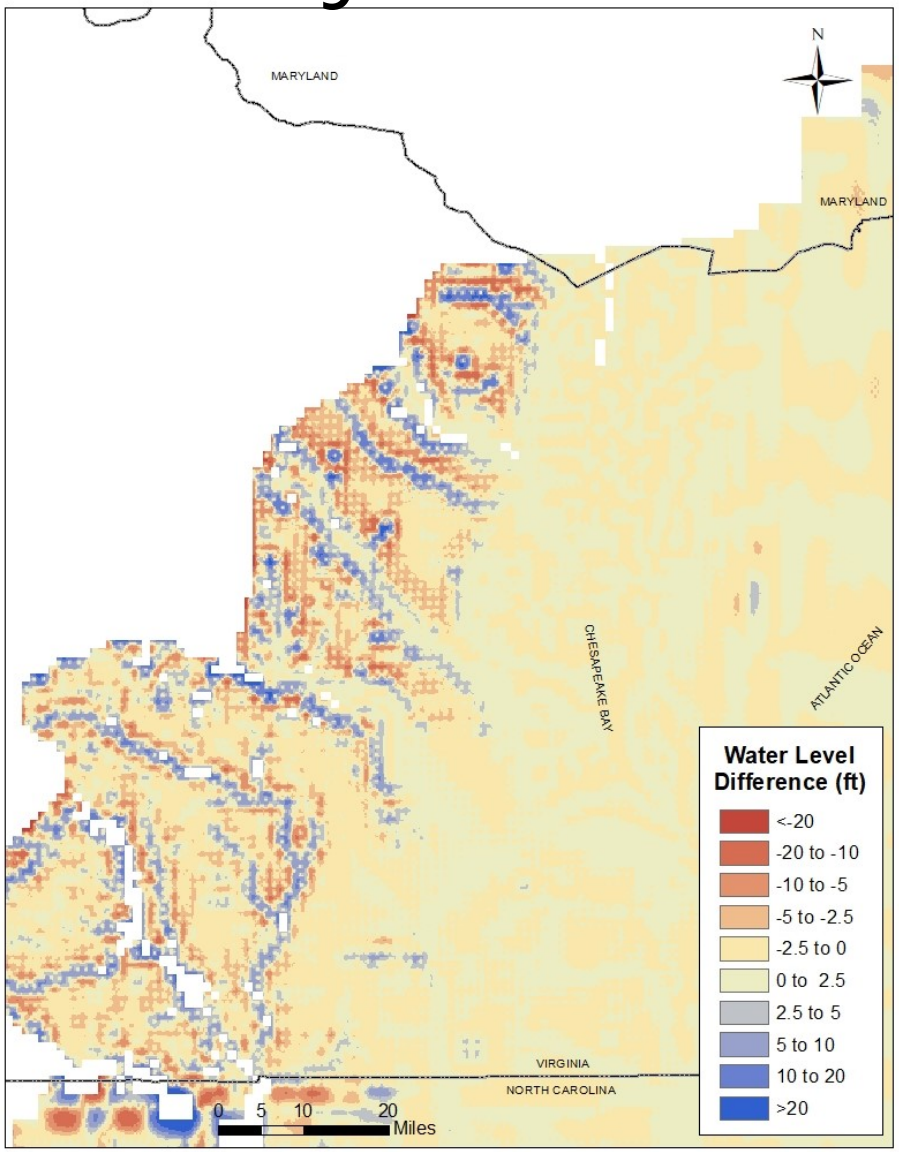
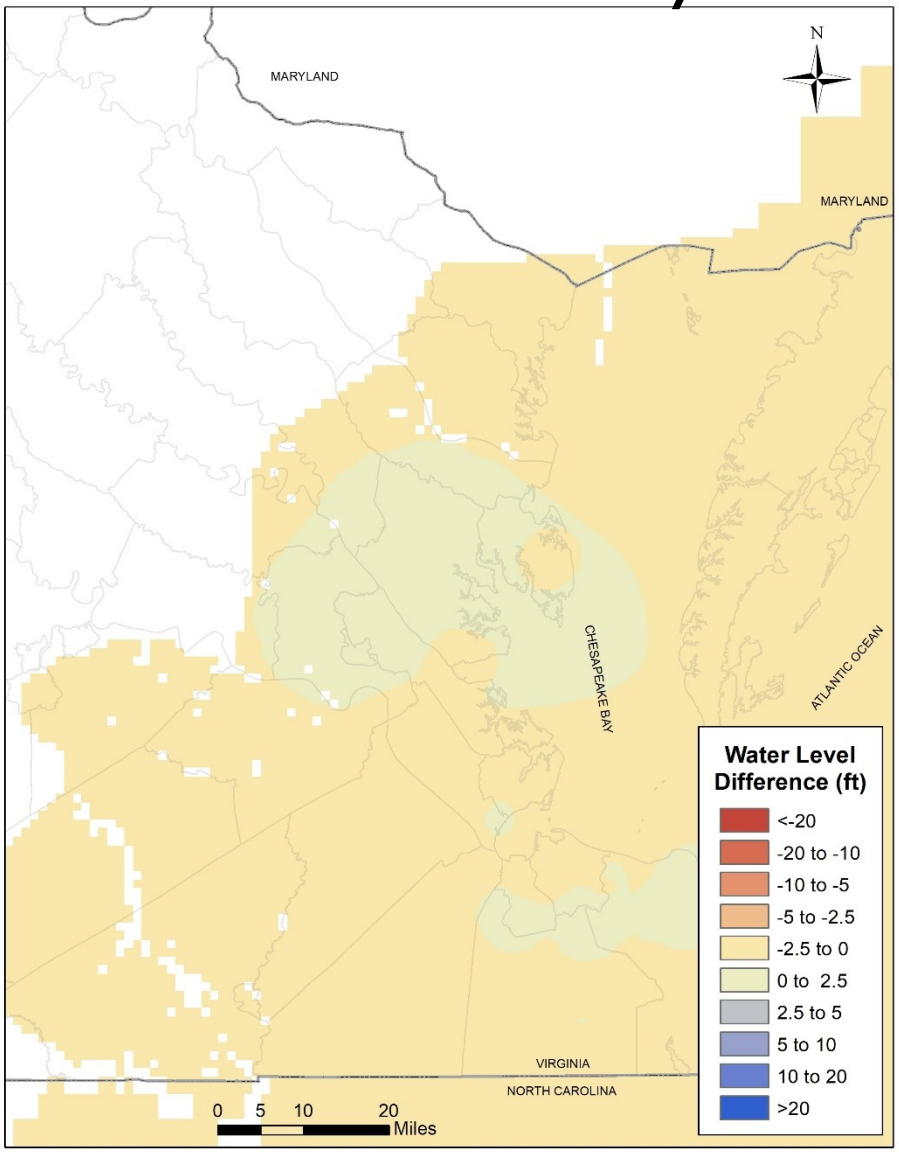


Water Modeling Solutions

DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

TP Simulations – Yorktown

2019 minus 2018



2018 minus 2017